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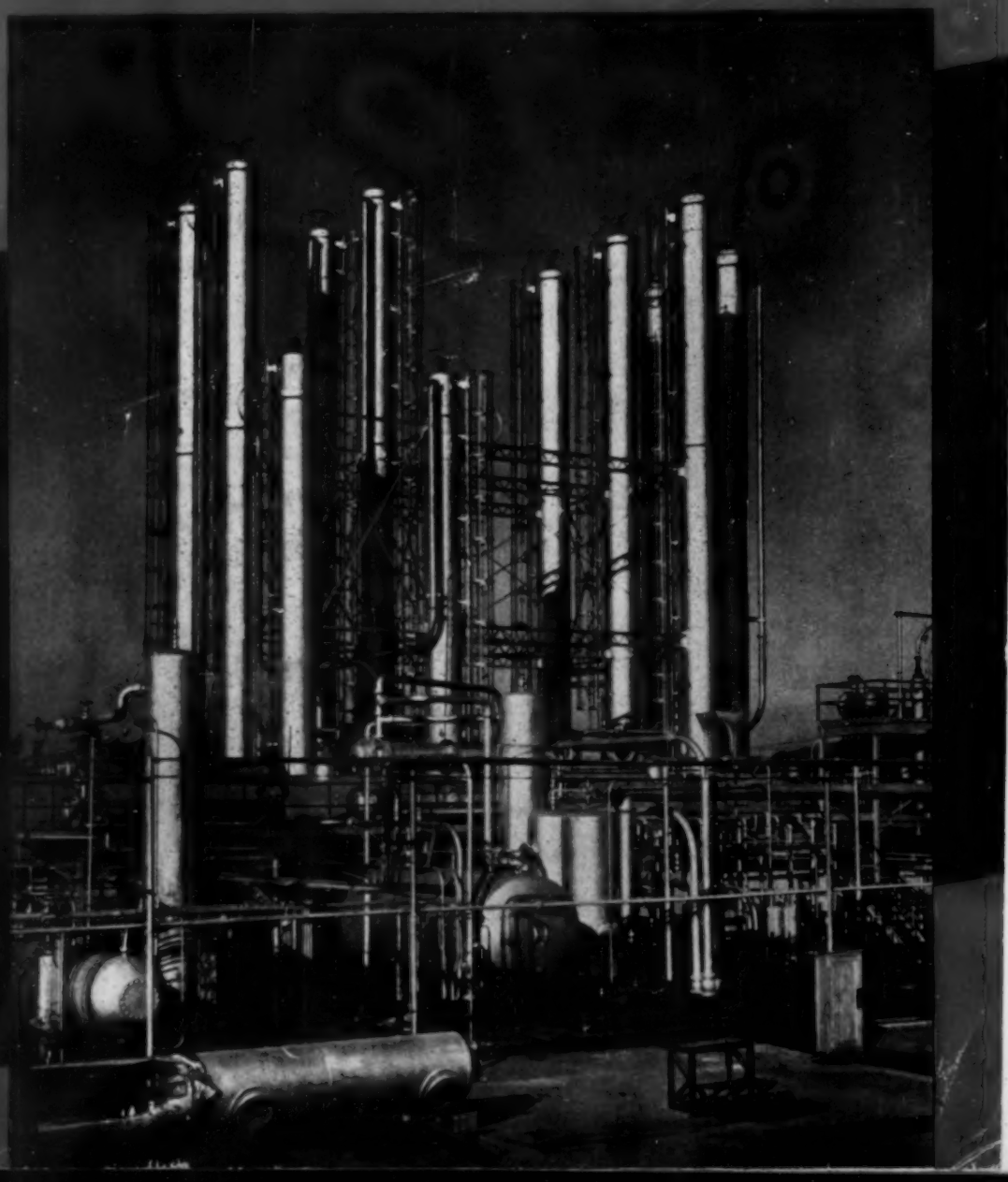
PTEMBER
1947

CHEMICAL ENGINEERING

WITH CHEMICAL & METALLURGICAL ENGINEERING



Chem & Met

issue features: a report the postwar develop- ts in the process indus- s of the 11 Western es, preview of Western m Show, continuous duction of phenol from ochlorbenzol, perform- e of agitators, magnesi- nsulation costs, estimat- metho s for process stries.

r Pictur Shell Chemical been on of the pioneering largest p ducers of petro- icals in e nation.

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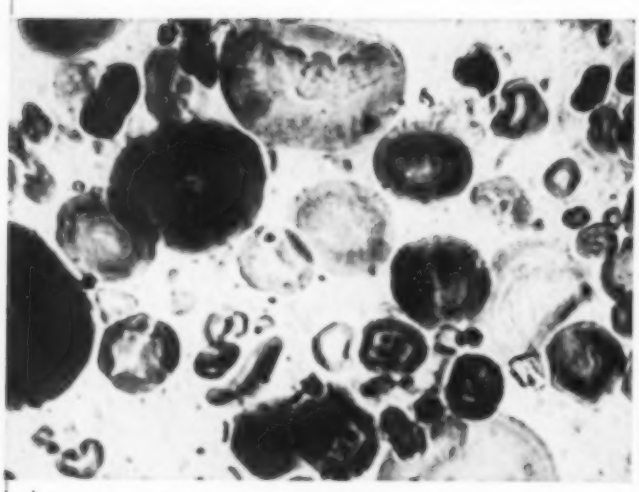
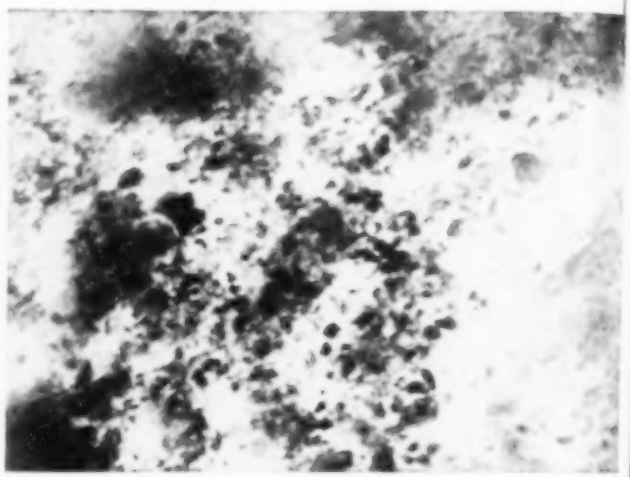
Vat Paste, for example



A

heated for 15 minutes at 210° F by conventional open kettle methods.



B

heated for 30 seconds at 230° F by continuous, closed Votator method.

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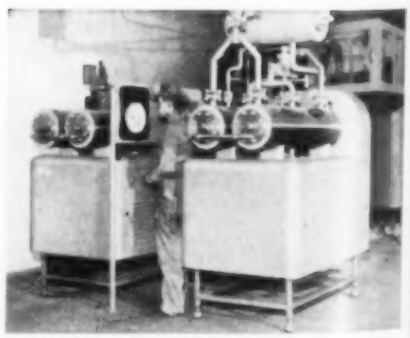

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Volume 54 Number 9

SEPTEMBER 1947

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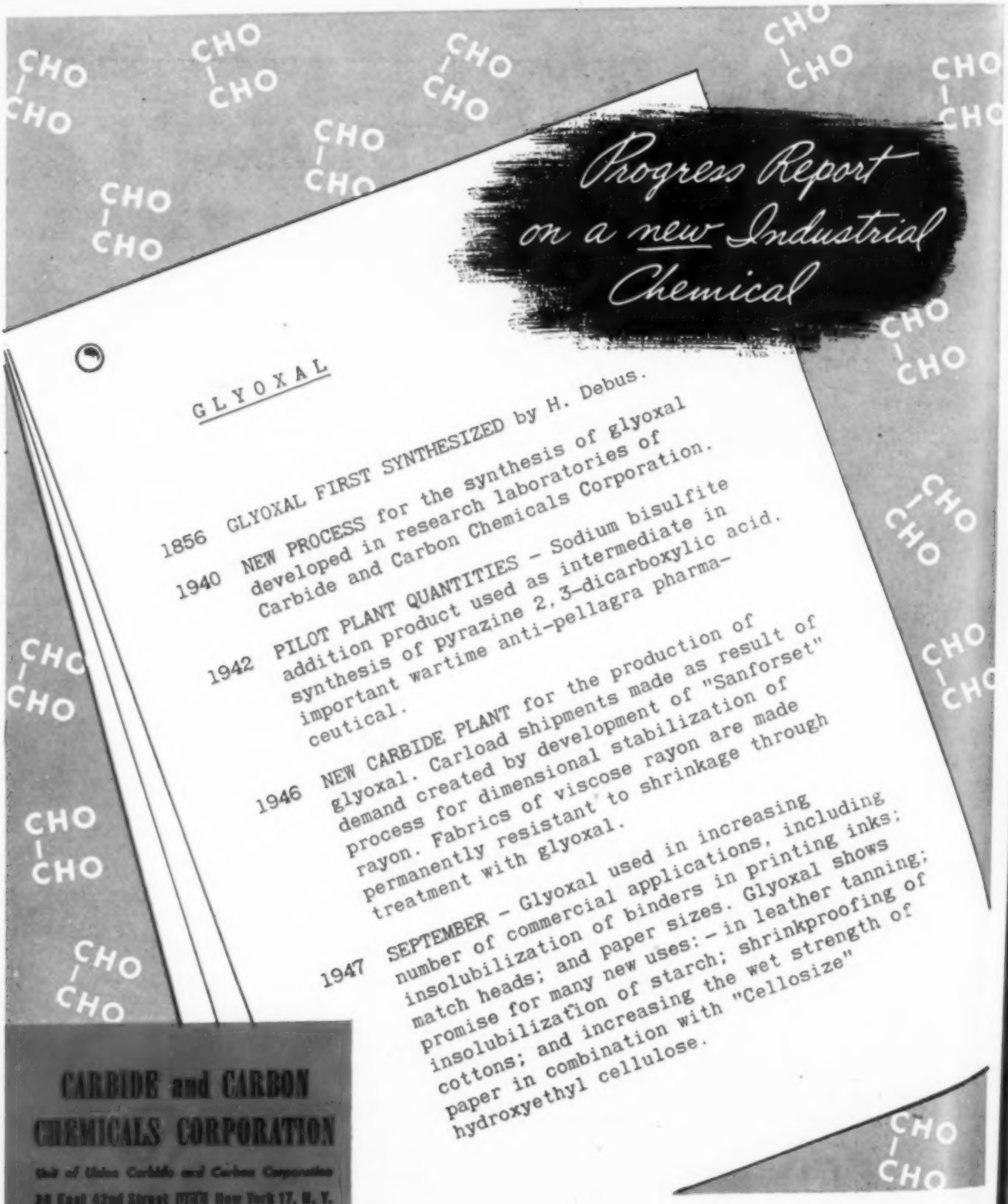
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1940 NEW PROCESS for the synthesis of glyoxal developed in research laboratories of Carbide and Carbon Chemicals Corporation.
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1946 NEW CARBIDE PLANT for the production of glyoxal. Carload shipments made as result of demand created by development of "Sanforset" process for dimensional stabilization of rayon. Fabrics of viscose rayon are made permanently resistant to shrinkage through treatment with glyoxal.
1947 SEPTEMBER - Glyoxal used in increasing number of commercial applications, including insolubilization of binders in printing inks; match heads; and paper sizes. Glyoxal shows promise for many new uses: - in leather tanning; insolubilization of starch; shrinkproofing of cottons; and increasing the wet strength of paper in combination with "Cellosize" hydroxyethyl cellulose.
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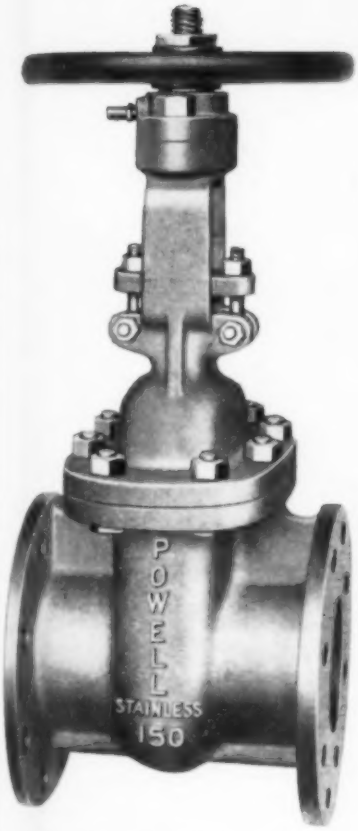

Fig. 2453-G—New, Standard 150-pound Stainless Steel Gate Valve with outside screw rising stem, bolted flanged yoke-bonnet and taper wedge solid disc.

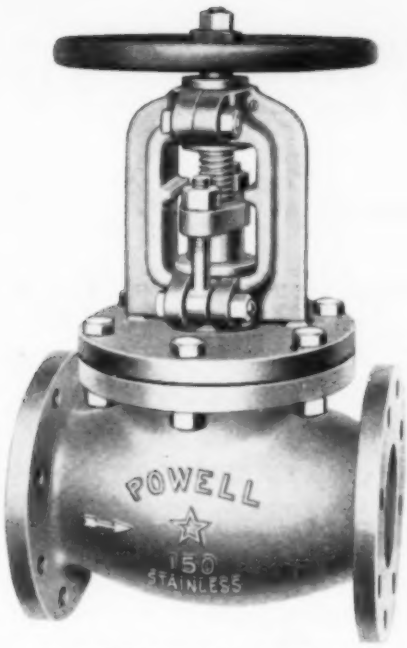

Fig. 2429—150-pound Stainless Steel O. S. & Y. Globe Valve. Has flanged ends and outside screw stem.

Fig. 1834 — 200-pound Monel Metal* Globe Valve with screwed ends, union bonnet, inside screw stem and plug type disc.

Fig. 1845—200-pound Pure Nickel Swing Check Valve with screwed ends, screwed-on cap and regrindable, renewable disc.

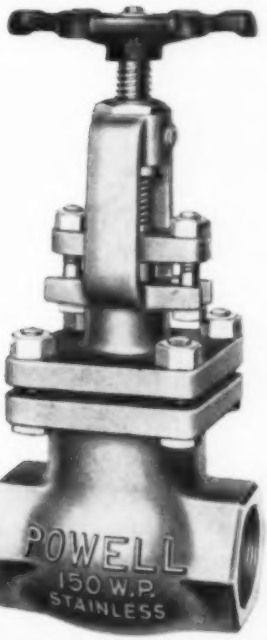

Fig. 1968—150-pound Stainless Steel Gate Valve with screwed ends, outside screw rising stem, bolted flanged yoke-bonnet and taper wedge solid disc.

Fig. 1830 — 200-pound Pure Nickel Gate Valve with screwed ends, screwed-in bonnet and inside screw rising stem.

Fig. 1944—Large Size 150-pound Inconel* "Y" Valve with flanged ends, bolted flanged yoke-bonnet and outside screw rising stem.

*A registered trade name of the International Nickel Company, Inc.

VALVES

WATCHING WASHINGTON

R. S. McBride, EDITORIAL CONSULTANT
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Career executives responsible for veto of National Foundation bill . . . Missouri Ordnance Works will be converted for production of synthetic fuels . . . New regulations for port loading of ammonium nitrate . . . Hearings will be held this fall on fundamental phases of the present tax law . . . Use of radio-isotopes already important in research programs . . . Proposed changes in national rubber policy meet industry opposition . . . New Mexico producing field added to national helium resources

Foundation Bill Vetoed

CAREER executives of some of the federal departments and agencies persuaded President Truman to veto the bill establishing a National Science Foundation. They found ready means of persuasion in the argument that the President should not lose control over the Foundation director as he might under the terms which made that executive responsible solely to the twenty-four members and the executive committee. Actually the basis of criticism lay deeper.

During the war period these career executives or their predecessors felt frequently snubbed by the non-career scientists who administered much of OSRD and NDRC. Apparently they do not want a perpetuation of scientific management in such non-career hands.

Liquid Fuels Research

BUREAU of Mines is taking up again the conversion of the Missouri Ordnance Works near Louisiana, Mo., from ammonia to synthetic fuels production. Originally started in 1945, conversion plans were interrupted when the plant was handed over to the War Department for production of ammonia for fertilizers by order of the Office of War Mobilization and Reconversion.

During the year the Army had the plant, the 80-odd administrative and engineering personnel attached to the project were working on plans at Torrance, Calif., headquarters of Bechtel Corp., which has the contract for the engineering, design, construction program necessary to the conversion job.

The new demonstration plant, which is expected to be in production by next June, will serve as a proving ground for different processes and different varieties of coal that can be used to convert coal reserves into liquid fuels to supplement the country's petroleum resources.

New Nitrate Practice

SOME CHANGES already have been made in the practice of ammonium nitrate manufacture. Others are still under consideration as the Interdepartmental Committee continues its investigations in Washington. First to come from that Committee was new regulations of port loadings put promptly into force by the Coast Guard before the middle of August. Other regulations officially recommended by the Committee were not available in time for this column.

One important change made at graining plants was the requirement that nitrate must not be bagged and loaded at such high temperatures as had been permitted in some cases. A maximum of 200 deg. F was fixed, and some plants had to slow down and change their finishing practice.

Still being studied were the relative merits of prilling and graining. Also questioned was the use of any combustible coating such as wax. Most radical of the changes being urged by some was a requirement that a sufficient inert component should be used so that the material would not be explosive under any possible conditions that might be met, even in the event of fire.

Suggested for this purpose were ground dolomite and ground phosphate rock. Either would make a mixed fertilizer of known value. It was argued that the use of dolomite would be particularly an advantage for use in the southeastern states where most soils require both magnesium and alkali component.

No one has been able to figure out just what will happen to the IEFC allocations of nitrogen from the United States for certain areas which were dependent on movement of ammonium nitrate, such as that which exploded at Texas City.

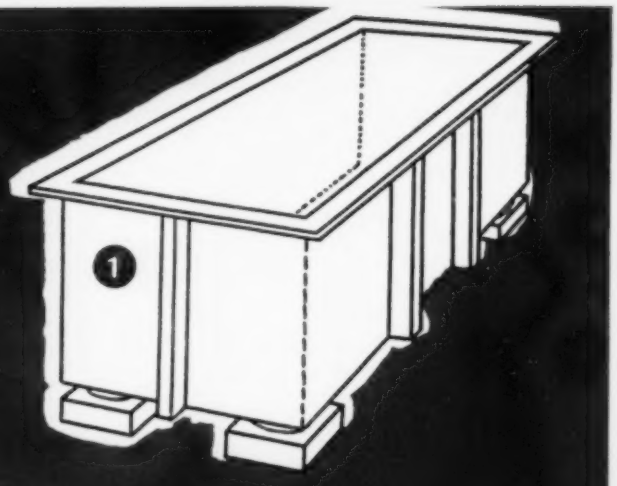
Domestic users of nitrogen compounds are expected to absorb any of the ammonium nitrate which can be made but not shipped through U. S. ports in commercial control. But IEFC may later demand that present deficiencies caused by this must be made up of other nitrogen compounds later in the year. That would seriously unbalance many industrial fertilizer programs. Army shipments will, of course, continue as described in another news item.

Nitrate Loading

PRIOR to the release of the government's Inter-agency committee recommendations for handling of ammonium nitrate fertilizer, spurred by the explosions at Texas City and Brest, France, the Army Transportation Corps and the Coast Guard took action to amend their regulations governing loading of nitrate aboard ship.

The Coast Guard emergency action forbids all loading or unloading of nitrate aboard ship without specific permission from the District Commander of the Coast Guard whose jurisdiction includes the port concerned. The Coast Guard representative is directed to withhold permission to load or unload if the operation is to be carried out in a congested area of the port. Issuance of the permit will be withheld until the vessel secures the use of loading or unloading facilities in port areas so remotely situated that, in the event of fire or explosion, the loss of lives and property will be minimized. The emergency order applies

Three Simple Steps for LOWER Tank Maintenance COSTS



Whether you line your tanks with rubber, plastic, brick, tile, lead or use them unlined, here are three simple steps you can take that will assure you longer tank life, lower maintenance costs:

1. Wherever possible see that tanks are installed with adequate air space underneath, and that all exterior surfaces are accessible for cleaning.

2. Coat all exterior surfaces, including the bottom, with Tygon Corrosion-resistant Paint—the all-plastic coating resistant to acids, alkalies, oil, water and alcohols. Don't be stingy. Do the job properly. Apply a coat of Tygon Primer and three coats of Tygon Paint. The cost shouldn't exceed 20 cents per square foot, including labor and materials.

3. Clean and inspect the outside shell occasionally. The glossy Tygon surface cleans easily. If you find a scratch or break in the film caused by carelessness, touch it up with fresh Tygon Paint. The job will be as good as new.

Wherever you have wood, metal or concrete surfaces exposed to corrosive fumes, gases or spillage—protect them with Tygon plastic paint coatings. You'll lengthen the time between recoatings 50% to 500%. And Tygon Paint costs no more than coatings that offer less than half the life.

Tygon plastic paint coatings are pure plastic in a solvent vehicle. Applied cold by spray gun or brush they dry to form a tough plastic film, resistant to the attack of acids, alkalies, oils, alcohols or water.

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Tygon Paint films bond tightly to metal, wood or concrete. They do not oxidize, show no chemical deterioration with age. Tygon Paint films are flexible, tough; resist impact without chipping or flaking.

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U. S. STONEWARE

Akron 9, Ohio

to all vessels, both Army and private.

Effect of the Coast Guard order will depend on the interpretations of it by the local officer who has the authority to approve or disapprove loading or unloading sites. Initially, at least, it had the effect of shutting off almost completely all shipments of nitrate in non-Army ships.

The Army, in addition, has issued new regulations which tighten up its own procedures for handling nitrate. Among the most significant are these:

1. The posting of a continuous fire watch on the ship during loading operations.

2. Thorough cleaning of the holds prior to the beginning of loading operations.

3. The prohibition against shipment of explosives or sulphur on a vessel carrying nitrate fertilizer.

4. The prohibition against carrying any other cargo in the hold in which fertilizer is stowed, or any other cargo in holds above or below a hold in which the fertilizer is stowed.

5. The prohibition against stowage of acids, flammable liquids, or cotton in holds adjoining those in which fertilizer is stowed.

At the same time the Army announced that its ammonium nitrate loading will be done at two Navy dock facilities built for ammunition handling. These are at Theodore, Alabama, where loading will be under Army supervision, and Earle, New Jersey, where the Navy will be in charge. Later it was announced that for economic reasons, loading at Earle would be discontinued.

At mid-August, it was anticipated that the inter-agency committee surveying the whole ammonium nitrate shipping situation would issue its report about Labor Day. It will contain recommendations for fundamental revision of nitrate shipping regulations. These recommendations will form the basis for new regulations to be put into effect after the usual procedures of public hearings are carried through.

"Preparedness" Plants

THE ARMY has worked out a plan to keep at least 60 industrial establishments in its preparedness program, always ready for industrial mobilization on short notice. Secretary of War Royall states that there are about 60 such establishments owned by the government in which Uncle Sam has invested something more than $2 billion. The importance of care of these regularly is indicated by the estimated annual maintenance cost in excess of $25 million.

Congress has now authorized the Army to make business arrangements with private enterprise for the peacetime use of each of these essential establishments. Formerly they could be leased for periods not exceeding five years. Now leases up to forty years are permissible. And new Congressional authority has been given for a businesslike lease arrangement.

When such an establishment, an arsenal for example, has civilian possibilities it may be leased in whole or in part on a long term arrangement. Part of the compensation to the government as rental can be the safeguarding and routine maintenance of the arsenal by the lessee company. If that firm provides guards, routine inspection, and minor maintenance services, the cost for this can be credited against the rental account. Or a low fixed rental can be given which takes account of this service. It is even possible for the lessee to provide for more extensive maintenance and repair jobs under Army supervision on a cost-plus basis. The plus is also credited on the rental account.

Obviously a company operating such an establishment can give the necessary care to insure good "standby" arrangement at much less cost than the Army would encounter if it had to maintain either a civilian or a uniformed group regularly at the plant solely for this service. It is hoped that the government can gain a substantial amount through such leases as a benefit on the maintenance accounts, and and that industrialists may find such long term leases much more attractive than previously. The War Department will welcome inquiries on any such project.

Tax Study Planned

BEGINNING this fall the Ways and Means Committee of the House of Representatives will hold hearings on all fundamental phases of the present tax law. Important spokesmen of business are expected to argue for many changes in principle as well as changes in rates. Income taxes for individuals and corporations will be considered as a part of the whole program. But it is probable that other classes of taxes will be more extensively discussed before the Committee between now and January.

Several divisions of industry have indicated they will seek to get fundamental revision of the exemption from taxation which is granted to certain classes of cooperative enterprise. If these special kinds of business firms were taxed as others it appears that they would pay federal income taxes of at least $5 billion per year. It is not anticipated that all of that will be taxed. Under fire most will probably be the exemption for that part of the co-op business which is not done directly as a service to members. Some co-ops, it is reported, do many times as much business for and with those who are non-members as with those who are dues paying and dividend getting. That part of the business should be taxable, it is argued, because it is in effect corporate enterprise directly competitive with other non-co-op business.

Also before the Committee will be questions of excise taxes and many administrative and interpretative features. There is some thought that Congress may also try to work out a division of the sources of taxation between federal and other subsidiary governmental agencies.

ANMB Rubber Proposals

THE BATTLE over a permanent national rubber policy which flared up with the issuance of the Army and Navy Munitions Board recommendations has quieted down again and probably won't be rejoined until October when members of the House Armed Services committee return from European junkets.

The ANMB proposals, submitted to the House committee which will produce the initial legislation for a permanent rubber policy after the first of the year, have been rejected in toto by the rubber products manufacturers although their views are not shared by petroleum companies which have an interest in the production of raw materials from which synthetic rubber itself is made.

What the ANMB proposed was a government-directed rubber program quite similar to the current set-up. A government committee composed of the Secretaries of Commerce, War, Navy and State would make general policy decisions to be carried out by a National Rubber Administration headed by a federal administrator. ANMB's plan calls for mandatory consumption of general purpose synthetic rubber at a minimum rate of 300,000 tons per year, and a plant capacity of 600,000 tons to be maintained either in operation or in standby status.

Such a program of mandatory consumption, the ANMB said, was preferable to the alternatives of subsidies or tariff-quota restrictions on natural rubber because it is the only method which assures consumption of the required amount of synthetic; it places all producers on an equal footing; both government and industry are familiar

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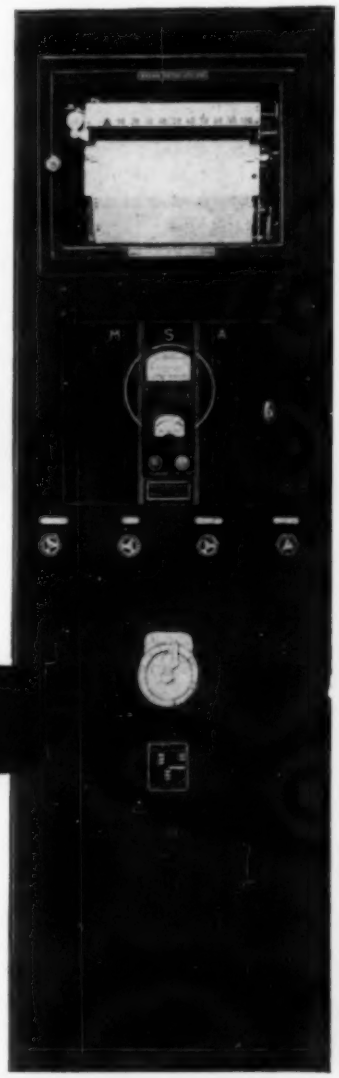

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with controls as they now operate; and it requires no appropriation of money by Congress, except for the amount necessary used by Department of Commerce in routine administration of the program.

The rubber products manufacturers, however, called such a proposal or anything similar to it completely unacceptable, and hinted at court action on constitutional grounds if the program should become law. The synthetic rubber plants now owned by the government should be sold to private industry, ANMB suggested, in such a manner as to insure operation of at least 300,000 tons annual production. The other plants, up to a total of 600,000 tons capacity, would be kept in standby by Federal Works Agency.

Isotopes Boost Research

Atomic Energy Commission's report on use of radio-isotopes in research, released last month reveals the speed with which industry has grasped available radioactive materials and incorporated them into their research programs.

Some 160 organizations already have received shipments of isotopes. Many of these are hospitals or medical research centers. But also included among the purchasers of the 100-odd isotopes produced at Oak Ridge are 27 industrial and chemical companies. University laboratories also make up a large group of isotope users.

These companies are: Shell Development Co., American Cyanamid Co., E. I. du Pont de Nemours and Co., Sinclair Refining Co., General Electric Co., Raytheon Mfg. Co., Parke, Davis and Co., Dow Chemical Co., U. S. Rubber Co., R.C.A. Laboratories, Bell Telephone Laboratories, Johnson and Johnson Research Foundation, Socony-Vacuum Oil Co., General Food Corp., Distillation Products, Inc., General Electric Co., The Texas Co., Houdry Process Corp. of Penn., Mellon Institute of Industrial Research, Publicker Industries, Inc., Gulf Research and Development Co., Industrial Radiography Laboratory, and American Smelting and Refining Co.

The Army's Hydroponics

Quartermaster Corps has produced a report on the operation of its hydroponic gardens that's an eye-opener. The Army's chemically-nurtured vegetable production-lines in British Guiana, China, Iwo Jima, and Japan are expected to produce in the current growing season about 2,000,000 lb. of tomatoes, 310,000 lb. f lettuce, 200,000 lb. of radishes, 440,000 lb. of cucumbers, 170,000 lb. of onions, and 60,000 lb. of peppers. Its biggest plants are in Japan—one of 55 acres near Tokyo, and another of 25 acres near Kyoto. Efficient management of these gardens, the Quartermaster Corps notes, can produce tomatoes for about one-half the cost of shipping them 1,000 miles in a refrigerator ship.

Cost of the chemicals needed to run a half-acre garden, the standard Army unit, runs to about $46.80 per month. Other costs for expendable items (not counting labor, overhead, or amortization of investment) amount to about $117 per month.

The Army's commonly used nutrient solution calls for the following fertilizer-grade chemicals: potassium nitrate, 19.8 percent; potassium sulphate, 27.3 percent; calcium sulphate, 27.3 percent; magnesium sulphate, 18.7 percent; monocalcium phosphate, 11.2 percent; and ammonium sulphate, 5.1 percent; plus small amounts of ferrous sulphate, ferric ammonium citrate, manganese sulphate, manganese chloride, boric acid, borax sodium tetraborate, copper sulphate, and zinc sulphate.

Petroleum Supply Outlook

Department of Commerce has entered the battle of predictions revolving around the critical or non-critical petroleum situation of the United States. This country will never have to import a major share of its petroleum needs, despite a gradual increase of imports, the Department declared in its report, "United States Petroleum Import Prospects," prepared by the Office of International Trade. It rejects the idea that the U. S. would be importing half its requirements within 20 years.

If domestic petroleum reserves were to become inadequate, the U. S. would be able to fill the deficit by manufacturing liquid fuels from non-petroleum sources, the report indicated. However, it emphasizes that it would be unrealistic to conclude that any one or any combination of the alternatives to petroleum would ever displace crude petroleum as a source of fuel.

Comparing costs of gasoline produced from petroleum with that which could be produced from natural gas and coal, the following figures are given: From coal, $3.78 to $4.62 per bbl. at the plant, and from natural gas $2.94 to $3.57 per bbl. These figures, which include an allowance of 63 cents profit per barrel, compare with March sales prices of refinery gasoline of $3.05 to $3.57 per bbl. at the plant. The report recognizes, however, that commercial developments of liquid fuels from coal and shale depend on a number of technical and commercial problems which are not yet solved.

Cost figures do point out, on the other hand, that gasoline from natural gas is competitive with gasoline from petroleum at present crude oil prices—and gasoline from coal or shale oil would be competitive if crude oil prices rose another 50 cents per barrel.

The report was an answer to predictions made some months ago by State Department petroleum advisors that the U. S. would be dependent upon foreign sources of supply for half its petroleum requirements by 1965.

New Helium Field

The helium-producing Rattlesnake field in San Juan County, New Mexico, is now part of the government's helium reserve as the result of Presidential approval of a law ratifying agreements with the Navajo Indian tribe and two oil companies. The field adds 25 to 30 percent to the proven helium resources of the United States.

The new law fills in a loophole in previous contracts which extended for five or ten years, or until the field ceased to produce oil or gas. With oil and gas production of the Rattlesnake field running low, there was the possibility of the government's contract lapsing sometime in the future. This possibility is now eliminated.

During the war, a helium plant to process gas was constructed at Shiprock, New Mexico. The Bureau of Mines has three other helium plants, but only one of them—at Exell, Texas—is in operation. This plant removes helium from commercial gas en route to market, and its output of helium is sufficient to meet current demands. The other plants are kept in standby condition.

Technical Men in War

The War Department, in cooperation with scientific societies, is finding out what happened to the country's scientific talent during World War II. First results show a high percentage of chemists and chemical engineers who got into the Army or Navy, considered their specialized experience was used only partly or not at all by the military services.

The first survey was conducted in conjunction with the American Chemical Society. Similar surveys are under way or planned by the Institute of Physics, Union of Biological So-

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cieties, the Geological Society of America, the American Assn. of Petroleum Geologists, the Association of Professional Geographers, the American Mathematical Society, the Engineers Joint Council, and the American Psychological Assn. In all, the War Department expects to have 35 or 40 societies cooperate in polling their members.

When the polls of scientists, via questionnaires, are completed, the scientific societies themselves hope to have documentary evidence to support what they contended was needed during World War II: a special pool for technical and scientific men to be drawn upon and used to the fullest in their special fields or collateral fields.

The surveys are being carried out under the direction of Dr. David M. Delo, of the Scientific Manpower Branch of the Research and Development Division of the War Department general staff.

Poll of the chemists and chemical engineers showed some interesting results. Out of 31,000 replies to 48,000 questionnaires, 15 percent had been in the armed forces. Of this group in service 78 percent were below 35 years of age, and almost half of them reported improper utilization. About one-fourth of the 35-and-over age group in uniform reported poor utilization of their capabilities. In all, about 40 percent of the chemists in service claimed they were utilized only part of the time, or not at all.

About 58 percent of all chemists and chemical engineers answering the poll reported that their principal war work was in industry; 8.5 percent said it was teaching; 17 percent said it was government-sponsored research or work for a government agency. Of those who got into military service, the survey shows that in general the youngest technical men were more apt to be poorly utilized. As a group, too, those who maintained their Army reserve status got called into uniform quickly in their basic branch, and never transferred to work that might more nearly match their professional qualifications.

High Costs Questioned

WHY DOES transportation of industrial materials cost so much in man-hours? This is a question which is being raised privately by certain industry spokesmen who are disturbed by the recurring demands of the railways for higher freight rates. These persons want to know why the man-hours per ton in transportation does not go down through improved technology. They wonder why the railroads do not accomplish improvements comparable with manufacturing industry where the productivity per man-hour is constantly increasing.

All these questions are stirred by the July request of the railroads for a blanket freight rate increase that, if granted, would cost shippers an additional billion dollars per year. Hearings scheduled to begin in September will first secure the carriers reasoning which lies back of this request. Shippers will then have their day before the Commission. Some well informed observers who are sympathetic with the railroads case think this appeal has been poorly timed because present earnings of the carriers are quite good. No experienced observers seem to think the railroads will get anything like the total requested which would average about 15 percent on all commodities. Process industries which pay huge freight bills are expected to appear in opposition to their part of the rate changes asked.

Procurement Procedure

STILL months away is the time when manufacturers dealing with the armed services can have any clear idea of just where and how they'll deal on a long-term peacetime basis. Military procurement legislation designed to spell out peacetime contracting procedures based on wartime experience got jammed up in Congress' rush to adjourn and failed of passage. It'll come up again next January. Meanwhile, present procedures continue under war powers.

Merger of the armed services has little immediate effect, except perhaps for sellers dealing with the Air Forces. This is because the merger isn't a merger at all; its a creation of an independent air force plus establishment of a top-level coordinating organization, the Defense Establishment. Over the long haul, the Secretary of Defense will doubtless continue and may accelerate the program of joint procurement of items common to the services which has been carried on hitherto by the Army-Navy Munitions Board. Firms dealing with the Air Forces may find some more immediate effects, on a policy level. Aircraft procurement policy is now a matter for Air Force decision rather than, as formerly, subject to the Undersecretary of War.

In the very long range, the new civilian National Security Resources Board which reports directly to the President and is independent of the services, may have some influence on procurement policy. Principal role of this new organization is to plan for the civilian side of organizing a war economy. It will set policies on such matters as stockpiling, relocation of plants, and the like.

Minor News Notes

Explosive mixtures of air and isobutane can be made non-explosive by addition of 39.9 percent of nitrogen or 26 percent of carbon dioxide, Bureau of Mines reports. Detailed information on the amount of inert gases needed to render other combustible-air mixtures non-flammable is contained in a report on "Extinction of Isobutane Flames by Carbon Dioxide and Nitrogen."

Termites have tried for 21 years to invade the timbers of the Department of Agriculture's first "termite test house" on an island in the Canal Zone where 45 different kinds of termites abound. Erected by the American Wood Preservers Assn., it demonstrates the effectiveness of coal-tar creosote and zinc chloride treated wood in repelling termites.

Forest pest control can now legally be managed on a big scale by the Secretary of Agriculture under an act approved by the President this summer. Public lands are so treated to control destructive insects and forest diseases at public expense. Near-by private lands are included in the program with arrangements for reimbursement to the Government.

"Operation Bumblebee" is the official program of the Navy for guided missiles. The popular designation "flying saucers" has not been admitted as having any connection with any Government project.

TVA appropriation includes $5 million which is earmarked for "chemical plant." Critics have claimed this as a scheme to get the wanted Mobile phosphate plant; but TVA says it has no authority to make such a development outside of the Valley area without specific Congressional action. Rebuilding and enlargement of facilities at Muscle Shoals is therefore expected though not officially announced.

Larger freight bills are expected to come ultimately from the recent I.C.C. approval of the higher car rental charged by the owning carrier to another railroad having one of its cars in use. The old daily rate was $1.25 which the railroads wanted to increase to $1.50; but I.C.C. upped the rate to $2.00 for daily rental.

CHEMICAL ENGINEERING

with CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902 SEPTEMBER 1947 SIDNEY D. KIRKPATRICK, Editor

Pacific Progress Report No. 5

PROVERBIALLY, it is difficult to evaluate the prospects and progress of the Pacific process industries. Periodically, we have attempted to do it on four previous occasions in the past sixteen years—in 1931, 1935, 1938, and 1941. Each time we have come up against a compromise between the views of enthusiastic Westerners, who frequently over-rate the region's near-future potentialities, and those of the skeptical Easterners who minimize the magnitude of growth and trends, and see only the West's great wide and empty spaces. This year the job is further complicated by the magnitude of the industrial metamorphosis that has occurred within the past pentad and is still under way. From it is gradually emerging a new regional economy in which the chemical engineer seems destined to play an increasingly important role.

REPORT

Fortunately, we have the benefit in our present survey of the full-time services of two editorial representatives in this important territory. John R. Callaham, Pacific Coast editor, and his assistant, James F. Cosgrave, have partially made up for the scarcity and lack of detailed statistics by digging out their own through personal contacts and correspondence. They have learned the local peculiarities of the region's industrial make-up, its economy, traditions, psychology, and topography as well as technology. And they have had a hand, too, in the pioneering progress of chemical engineering as a profession on the Pacific Coast—an advance that will reach a climax October 21-25 when the first Pacific Chemical Exposition and Industrial Conference will be held in San Francisco's civic center.

An attempt is made in the following pages to analyze briefly and broadly some of the factors that affect the status of the West as a chemical producing and chemical consuming unit. Among these factors are three of special significance: (1) As population and per capita income have advanced at rates faster than those for the nation as a whole, there has been a corresponding increase in the demand for consumer goods. (2) Intensified industrialization of the Coast since 1939 has created new markets for industrial chemicals and semi-manufactured materials that are not yet being produced in the eleven Western States. (3) Significantly, the chemical and allied industries of the West have lagged somewhat behind the national rate of increase so that there are still attractive opportunities for chemical enterprise and cultivation.

But the authors are vehement in their warnings that the days of the gold rush are over, that remaining opportunities must be carefully studied to make certain that the consuming industries are well integrated into the permanent economy of the West, and that the market offered is large enough to guarantee economic operations. Such studies must go beyond and beneath the brief summaries and statistics presented here. They call for frequent and intensive surveys in the field by technically trained investigators.

Next month would be a good time to start such an investigation for your company. Plan to meet us at the Pacific Chem Show on October 21.

Sidney D. Kirkpatrick

MORE PEOPLE, MORE FOR PACIFIC

JOHN R. CALLAHAM and JAMES F. COSGRAVE
Pacific Coast Editor and Assistant Editor, respectively,
of Chemical Engineering, San Francisco, Calif.

In the seven eventful years since 1939 the eleven Western States have led the nation in a program of industrialization. Significantly not all of the chemical and process industries have kept pace with this development. But as population and manufacturing have advanced at a rate faster than that for the nation as a whole, there are corresponding markets and opportunities for chemical cultivation. Continued growth and industrial integration are certain to characterize the West.

POPULATION-WISE, the record of the West is clear-cut and bold. The region, particularly the Pacific Coast, is the most rapidly growing segment of the nation. Look at the accompanying table; in the past six years, the three coast states have increased in population by some 36 percent. Numerically, this means 3,500,000 additional people since early 1940 or more than a third of the nation's entire gain since that date. Pacific Coast population now approaches 13,200,000 or some 9.4 percent of the country's total. This increment, of course, was greatly stimulated by the war. Reliable studies, however, show that the migration is continuing and will most likely result in a population of close to 15,000,000 by 1960. So far, there are no serious indications that the economy of the region cannot absorb its population gains.

In terms of percentages, the West's place in the national sun is reduced to its true perspective and becomes more modest. In 1940, the eleven Western States had 10.5 percent of the United States population; this has been raised to about 12.5 percent. The Pacific Coast upped its rating from 7.4 to 9.4 percent. California, where the largest numerical growth has been in the Los Angeles basin while the highest percentage increase has been in the San Francisco Bay area, jumped from 5.2 to 6.8 percent of the national total.

More people, especially those with the average Westerner's high per capita income, means more homes and schools (and churches), automobiles and tires and gasoline, swimming suits and beer bottles, drug and dry cleaning establishments—and of all the chemicals that go into the manufacture and servicing of man's necessities and luxuries. The growth of Los Angeles, now one of the largest metropolitan areas in the country, has already had a marked effect on the consumer-type chemical manufacturing industry of California.

More Manufacturing Means More Industrial Markets

IN ALL MANUFACTURING industries, as measured by number of production workers, most of the industrialized Western States are continuing to operate at a considerably higher rate than the nation as a whole. Data, unfortunately, are not complete or always comparable, but it is evident that manufacturing industry in the Pacific Coast states is operating at close to 170-172 percent of the 1939 index as compared to 150 percent for the United States. California, with a rate of 169 percent, is led by Los Angeles at 185. Admittedly, production worker employment is not an ideal or even balanced index of industrial output.

This higher rate of total manufacturing activity is to be expected as a result of the intensified industrialization of the Coast since 1939. Since a large number of major plants are not yet in operation, or even built, it would seem probable that production worker employment will be materially increased by 1949. Since the end of the war, something like a fifth of the value of all private non-residential construction has taken place in the West, largely on the Coast (see chart). California is second only to Texas in value of such construction, while the Pacific Coast states have averaged over 15 percent of the national total since 1939. In terms of growth, the value of private non-residential building for these states has increased five-fold since that year. According to *Engineering News-Record*, the backlog of proposed private *industrial* construction for the West through December 1946, amounted to

STATUS OF THE PACIFIC COAST IN THE NATION

As Percentage of National Total[1]

	1939	1946
Population[2]	7.4	9.4
Total manufacturing[3]	5.3	6.1
Chemical & allied manufacturing[3]	4.5[4]	4.2
Industrial chemicals manufacturing[5]	5.3	6.1

[1] Approximated. [2] As of April, 1940 and estimated January, 1947. [3] In terms of manufacturing production workers, U. S. Bureau of Labor Statistics and Bureau of the Census. [4] Estimated. [5] Estimated from various data not exactly comparable. Includes industrial chemicals, explosives and small-arms ammunition, compressed and liquefied gases.

PLANTS, MORE MARKETS PROCESS INDUSTRIES

THIS OVER-ALL PICTURE IS A PREFACE TO SUBSEQUENT EVALUATIONS OF THE CHEMICAL PRODUCING AND CHEMICAL CONSUMING INDUSTRIES

16 percent of the national total.

Thus the relative rate of industrialization of the West is impressive; how has its national rank been affected? In 1939, the Pacific Coast states employed about 5.3 percent of the country's total production workers engaged in manufacturing. For 1946, the figure was 6.1 percent. The corresponding status of California was 3.4 and 4.0 percent. It requires a lot of new jobs to raise a region's national rank by one percent—but the difference can create a market, such as for chemicals, worthy of competition.

With 9.4 percent of the country's population but only 6.1 percent of manufacturing production worker employment, the Pacific Coast industrial economy shows a lag that is only natural and to be expected in a youthful region. However, as population grows it is also logical to expect that this differential will be constantly narrowed—in other words, the West's economy will hinge more on industry and less on agriculture, mining and services.

More Chemical Processing But Still Not Enough

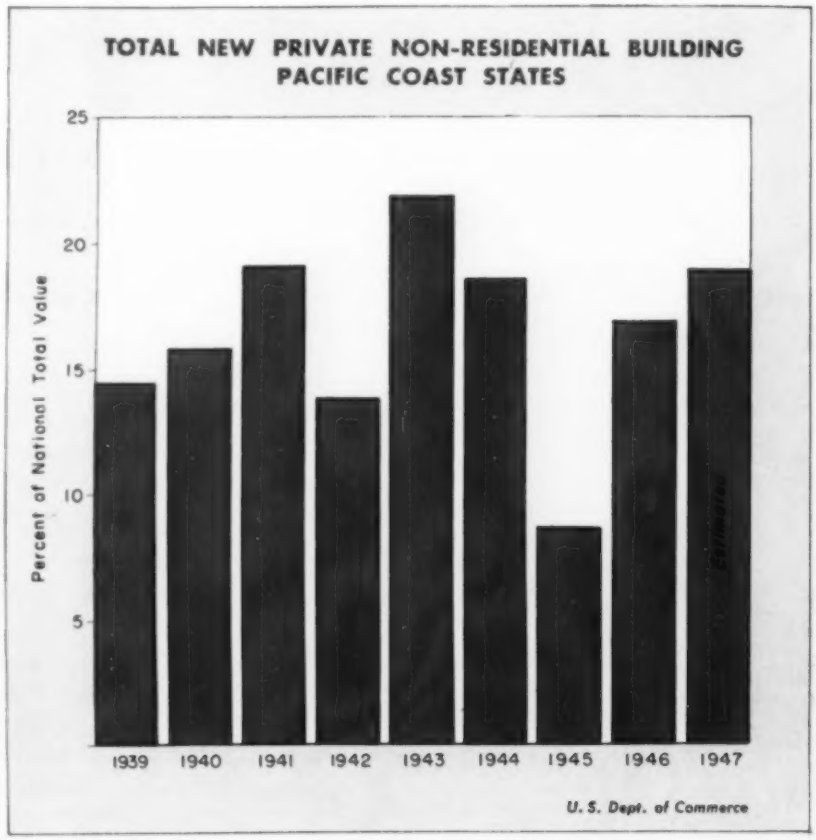
FOR THE PROCESS industries, an analysis of the chemical and related products manufacture of the West becomes really significant. Here again, data are incomplete and highly unsatisfactory. Unfortunately, most of the states have not reported production workers on a comparable basis, or even at all. Other fragmentary barometric data are even less satisfactory. Statistically, it is difficult to isolate the chemical economy of any region from that of the nation as a whole.

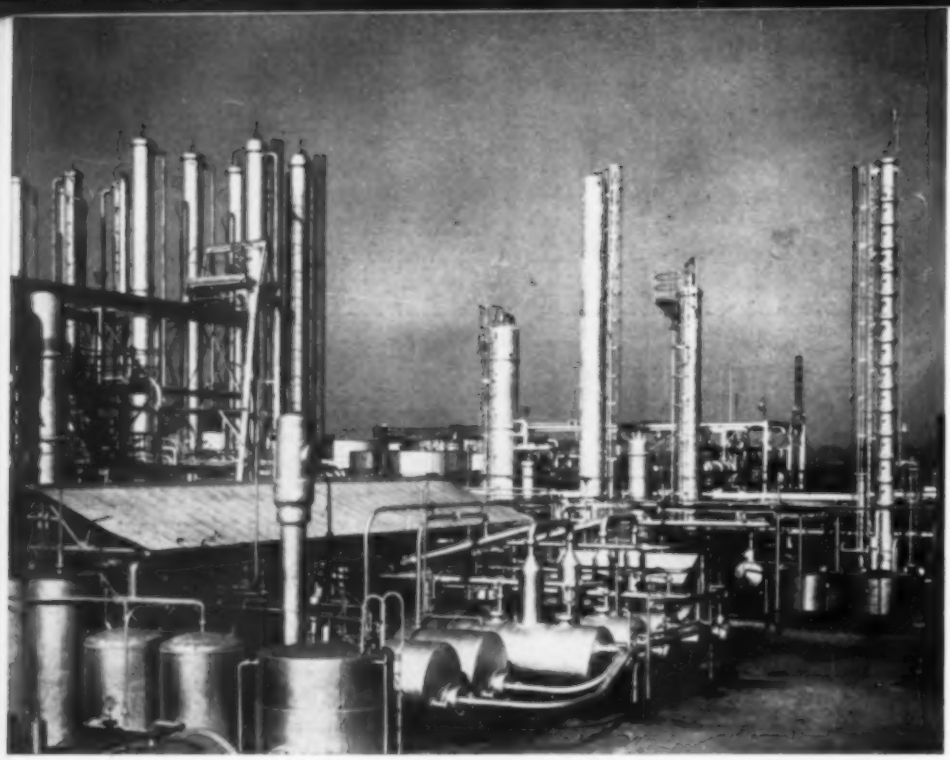
Since 1939, the growth (again meas-

PER CAPITA INCOME PAYMENTS TO CIVILIAN POPULATION*

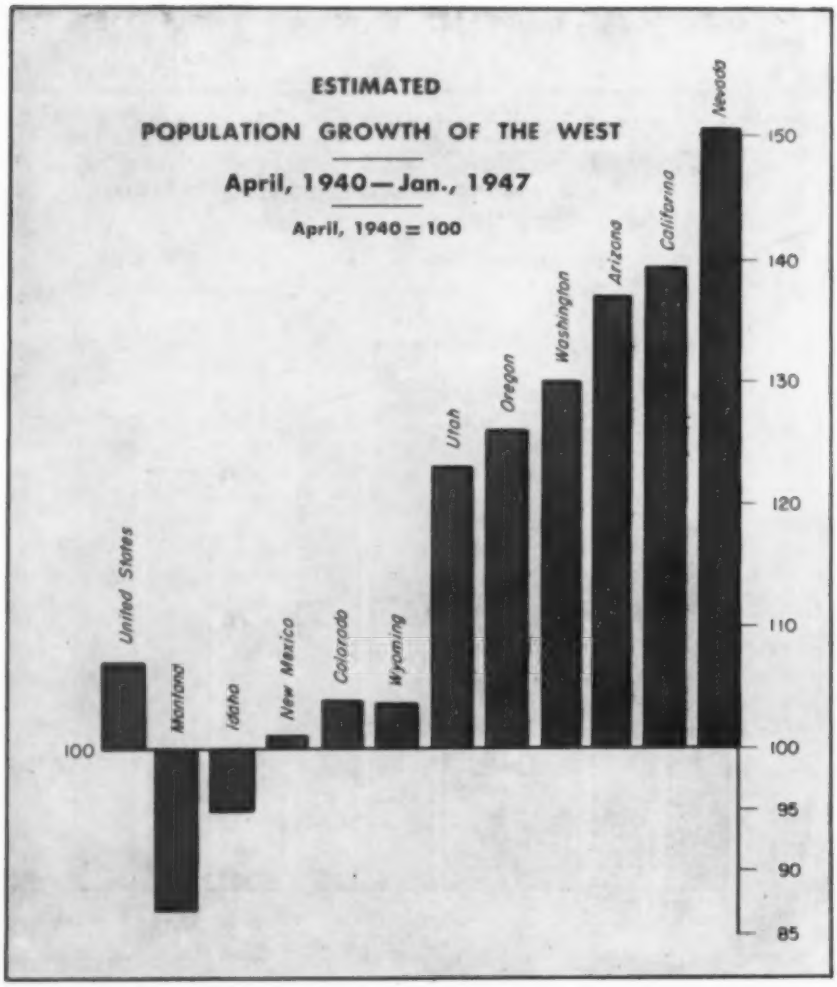
	West Coast	California	Oregon	Washington
1940	130.2	140.1	100.9	109.2
1941	134.3	141.4	108.5	121.3
1942	138.4	141.2	123.5	136.4
1943	139.5	142.6	120.5	138.7
1944	135.0	137.4	116.4	136.7
1945	128.2	131.8	109.8	125.0

* Basis United States average = 100. U. S. Bureau of Labor Statistics.





This spanking-new California petrochemical plant, source of alcohols and ketones, typifies the status of synthetic organics in the West—they are new, they are pioneering, they are growing

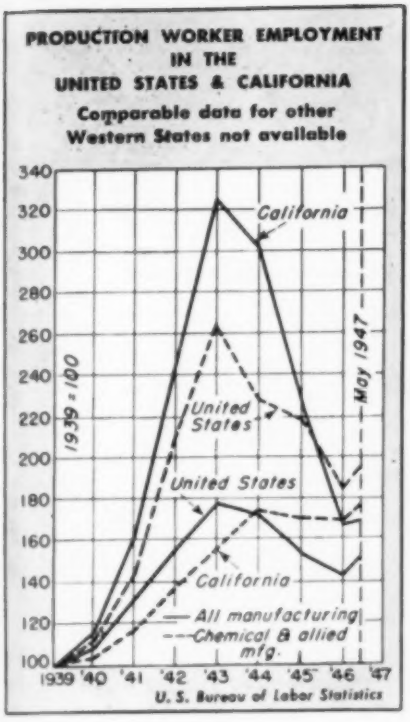


ured by the unsatisfactory gage of production workers employed) in the chemical and allied industries of the West has lagged somewhat behind the national rate of increase (although a recent change in the U. S. Bureau of Labor Statistics' index clouds the true picture even further). For 1946, the chemical and allied products industries of California rose to an index of 168 (1939 = 100), Washington to 223, Oregon to about 137 and Utah to 129. This segment of the national industry increased to an index of 185. However, perhaps of greater significance, the Pacific Coast percentage of the nation's total chemical and allied industries increased, on the same basis, from 3.7 percent in 1945 to 4.2 in 1946 and 4.3 in May, 1947. This would indicate that the region is now catching up and perhaps passing the national rate of growth.

California, which employs close to 70 percent of the chemical and allied workers in the West, dropped in national rank from 3.4 percent of the total in 1939 to 2.1 percent in 1943, but rose again to 3.1 percent in 1946. Evidently the state made less gains during the war years, but has retained them better. During the same period, the percentage of chemical and allied workers in the nation increased from 3.5 to 4.6 of all manufacturing, but in California the figure remained at 3.6 percent of the state's total. With most of the large postwar expansions still not in operation, the gains in California within the next year or so should be marked and will probably raise the state's national rating.

Furthermore, there are segments of this industrial category that are nonexistent or relatively small on the Coast —synthetic fibers, chemicals, drugs and medicinals, fertilizers, plastics chemicals—that tend to lower the region's comparative rank. All of these are expected to expand considerably within the next few years since their absence is more a case of retarded integration than a lack of markets. Better integration is incipient.

In respect to industrial chemicals, the Pacific Coast and the West are definitely gaining in comparison with the nation as a whole. The Californian heavy chemical industry is now operating, on the basis of production workers, at 190 percent of the rate for 1939 —about 10 to 12 points higher than the national average. The rates are even greater for Oregon (230), Washington (about 220), Nevada and possibly for Utah and Colorado. It is probably safe to state that the West's heavy chemical industry is now employing twice the number of production workers as for 1939.



Plants like these in Oregon make Western pulp and paper production tops

What Conclusions and What to Do About Them

From this analysis, it is evident that the West, particularly the Pacific Coast, is expanding at a rate faster than the nation as a whole in respect to population, total manufacturing, industrial chemical manufacturing and to a lesser extent in total chemical and allied products.

An accompanying table, summarizing the change in status since 1939 of the Pacific Coast in relation to the nation, shows the lag between total manufacturing and population and between chemical and allied products and all manufacturing. This is certainly the natural order of things in a youthful and rapidly growing region. Without doubt, as the area becomes more mature and stabilized, these gaps will be narrowed—but never completely closed, since the industrial economy of the West is but a part of the greater economy of the United States.

Nevertheless, the magnitude of these differentials is in a broad sense indicative of markets and opportunities; the speed and extent of the narrowing will be a gage of the region's internal demand-supply integration and independence of commodities manufactured elsewhere. In short, the bigger the gaps, the more opportunity for local manufacturing enterprise—*provided* that the market is large enough to guarantee economic operations and that all other factors are equalized.

For the chemical manufacturer, perhaps the only safe way to keep tabs on Western markets is by means of frequent field surveys for each commodity or related group of commodities. Published statistics are usually too meager to serve as effective indices. Since both the consumption and production of chemicals are growing rapidly, trends are particularly important to watch. Perhaps more valuable even than the growth rate of the region is the degree of integration of a given industry or of a given area. For many items, particularly those in very short supply, the present consumption (or even demand) has little meaning, since the consuming industry is largely nonexistent. Instead, the potential must be stressed. In such cases, the manufacturer has an opportunity to create new markets.

Continued growth and integration will characterize the West's chemical and process industry economy for many years, offering both opportunities and challenges to the chemical, raw material and equipment manufacturer and supplier, whether located in the West or in the East.

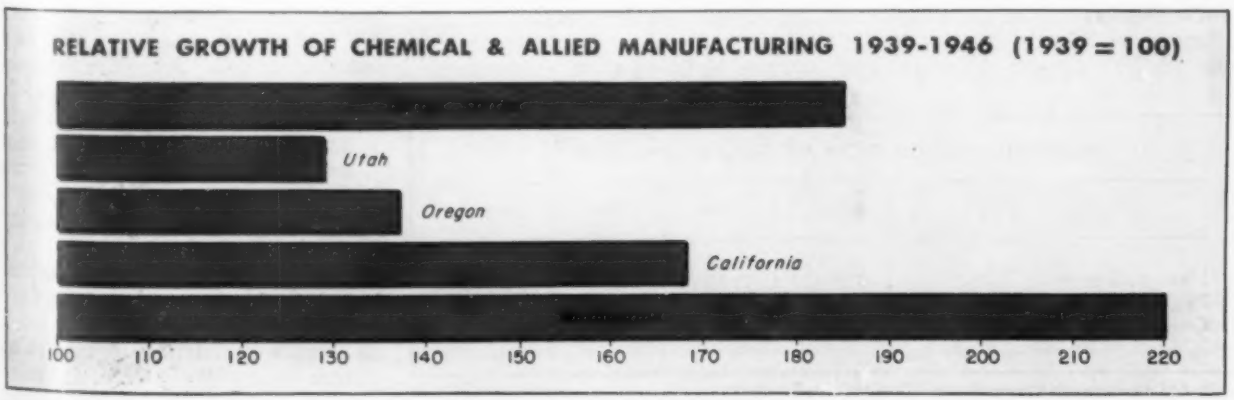


Chart compares average 1946 employment with average 1939 employment. Since data are reported on different bases, the percentage growth of each state cannot be compared with that of the others nor, excepting California, with the U. S. total.

CHEMICAL PRODUCING INDUSTRIES

Sulphuric Acid—Industrial Barometer Says Fair and Clear

KING of heavy chemicals, sulphuric acid production is often used as the barometer of the chemical industrialization of a nation or of a region. Sulphuric-wise, the West is mature and well integrated, having 16 of the nation's total of 171 primary producing plants. Expansion in production of the area has been considerable since 1939, representing approximately 85 percent. With the steady growth of the chemical process industries in the West, new and expanding markets for sulphuric acid are appearing; these will be matched by further expansions in the acid industry.

In 1939, the West's new production of 100-percent acid amounted to some 376,423 short tons or 7.8 percent of the national total. In 1946, the output increased to 588,336 tons or 6.8 percent of the total. Among the new facilities are several government financed expansions, including the 180-ton unit at Richmond, Calif., recently purchased by General Chemical Co. In 1945, Garfield Chemical & Manufacturing Co. began operating a new 150-ton unit at Garfield, Utah, bringing this plant's capacity to 250 tons daily. Largest Western acid consumption is in the three coastal states, where nine producing units now have a daily capacity in excess of 2,000 tons of 100-percent acid, well over 100 percent greater than for 1935.

Expansions planned or approved for the industry include: a new plant at Phoenix, Ariz., to use autoxidation by means of a liquid catalyst (see *Chem Eng.*, May 1946) in connection with a sewage treatment project; a new plant near Portland, Ore., to be operated in conjunction with a proposed zinc smelting operation; and expanded facilities in the San Francisco Bay area. Further conversion of petroleum refinery H_2S is likely.

Area in which markets are apparently out-stripping production most rapidly is the Puget Sound-Lower Columbia basins in Western Washington and Oregon. Monthly consumption in this area is now probably reaching 2,000 tons or more, excluding that used at Salem, Ore., for producing ammonium sulphate. Major new or expanded markets for sulphuric acid in the West include those for petroleum refining, synthetic detergents and wetting agents, steel producing and fabricating plants in Utah and the Pacific Coast, superphosphate and ammonium sulphate, storage batteries, alum, electroplating, atomic energy, alcohol by wood hydrolysis, DDT, sugar refining, chemicals, and paper products. Uses which may become substantial consumers in the near future include synthetic phenol, acetic acid from acetylene, ion exchange regeneration in beet sugar factories, and the West's embryonic textile industry.

WESTERN PRODUCTION OF SULPHURIC ACID*

	1939	1944	1945	1946
New production	376,423	718,120	690,466	588,336
Percent national production	7.8	8.4	8.0	6.8
Consumed in producing plants	36,611	44,583	†56,329	.....

*As short tons of 100 percent acid. Does not include output from government-owned plants operated in conjunction with ordnance works and arsenals. From Bureau of the Census. †For January through September only.

Other Inorganic Acids—HF Arrives; Old Timers Thrive

WITH inorganic acids other than sulphuric, the principal developments in the West since 1939 have been the production of hydrofluoric acid by General Chemical Co., phosphoric by Maas Chemical Co., and the increasing amounts of hydrochloric produced, mostly as a byproduct of chlorination processes.

Hydrofluoric acid, anhydrous and aqueous, is made in a new unit at El Segundo, Calif., by General Chemical Co. for petroleum alkylation, manufacture of sodium and ammonium fluorides and for other uses. This represents the first production of HF and fluorides in the West. Phosphoric acid consumption on the Pacific Coast has been steadily increasing for food and beverage purposes, metal treating and as a fertilizer used in irrigation water. Since 1941, Maas Chemical Co. has begun manufacturing several grades of this acid at South Gate, Calif., by burning elemental phosphorus. In addition, Simplot Fertilizer Co. recently announced plans to produce phosphorus, phosphoric acid and triple superphosphate in an electric furnace plant in Idaho (see section on fertilizers).

Due to several new organic chlorination operations, there is recent activity in the field of byproduct hydrochloric recovery. The situation

has not yet been clarified, and inconsiderable amounts of acid are being recovered. Among the recent new uses for muriatic acid in the West are the tungsten operations of U. S. Vanadium Corp. at Henderson, Nev., the starch hydrolysis units of Northwest Chemurgy Cooperative in Washington and Oregon, and spray residue removal from fruit. Last year's nitric acid output approached 50,000 tons, almost 9 percent of the national total.

Caustic and Chlorine—Swift Moving Industry Triples

EVENTS have moved swiftly since 1935 for the West's chlorine industry. In that year there were three producers operating at the rate of about 120 tons daily. The output approached 200 tons by 1940 and close to 400 tons by the close of 1946. By crawling out on a limb, one can "guesstimate" that by mid-1948 or somewhat later there will be seven electrolytic plants with a possible total capacity of 750-775 tons operating at a rate anywhere from 500 to 700 tons—depending on business conditions, whether the 100-ton plant in Denver attains capacity and what happens to the 225-ton plant at Henderson, Nev., which has been operating at about 50 percent capacity. The maximum capacity figure would represent over 15 percent of the total projected capacity of the nation.

An analysis of what has happened since 1939 is certainly in order. Two small operators, one each in New Mexico and California, have ceased operations. In 1942, when the giant Basic Magnesium project at Henderson, Nev., was being erected a 225-ton electrolytic chlorine plant was built to be used in producing $MgCl_2$ cell feed. The entire plant was soon closed down, but in 1945 Stauffer Chemical Co. began operating about half of the cells. Part of the chlorine and caustic is used by other firms that have established operations at Henderson, part is shipped to other points. While ultimate fate of this entire project remains in the air for a number of reasons, the chlorine-caustic operations probably have a better-than-even chance of becoming the nucleus of a large and basic chemical center in the West.

Second big chlorine plant to be built since 1939 in the West is that at the CWS Rocky Mountain Arsenal near Denver. This plant had a total capacity of 100 tons daily, a liquefying capacity of 20 tons. Early in 1947, Colorado Fuel & Iron Corp. leased

[PRIMARY PRODUCERS OF SULPHURIC ACID IN THE WEST*

Company	Plant Location	Process
American Smelting & Ref. Co.	Selby, Calif.	Contact
Anaconda Copper Mining Co.	Anaconda, Mont.	Chamber
Apache Powder Co.	Benson, Ariz.	Contact
E. I. duPont de Nemours & Co.	DuPont, Wash.	Contact
Garfield Chemical & Mfg. Co.	Garfield, Utah.	Contact
General Chemical Co.	Port Chicago, Calif.	Contact
	El Segundo, Calif.	Contact
	Richmond, Calif.	Contact
	Denver, Colo.	Contact
Inspiration Consolidated Copper Co.	Morenci, Ariz.	Contact
Phelps-Dodge Co.	Douglas, Ariz.	Chamber
Standard Oil Co. of Indiana	Casper, Wyo.	Contact
Stauffer Chemical Co.	Stege, Calif.	Contact
	Dominguez, Calif.	Contact
	Vernon, Calif.	Contact
	Torrance, Calif.	Contact

*Includes sulphuric acid of oleum grade. Primary producers in Canada include Canadian Industries, Ltd., at New Westminster, B. C., Consolidated Mining & Smelting Co. at Trail, B. C., Nichols Chemical Co., Ltd., at Barnet, B. C.

WESTERN PRODUCERS OF INORGANIC ACIDS OTHER THAN SULPHURIC*

American Cyanamid Co.	Azusa, Calif.	HCN
American Potash & Chemical Corp.	Trona, Calif.	H_3BO_3
Anaconda Copper Mining Co.	Anaconda, Mont.	H_3PO_4
Apache Powder Co.†	Benson, Ariz.	HNO_3
Dow Chemical Co.	Pittsburg, Calif.	HNO_3, HCl
E. I. duPont de Nemours & Co.	DuPont, Wash.†	HNO_3
	El Monte, Calif.	HCN
	Louviers, Colo.	HNO_3
General Chemical Co.	El Segundo, Calif.	HF
Harshaw Chemical Co.	El Segundo, Calif.	H_2WO_4
Hercules Powder Co.	Hercules, Calif.	HNO_3
Hooker Electrochemical Co.	Tacoma, Wash.	HCl
Los Angeles Chemical Co.†	Los Angeles, Calif.	HNO_3
Maas Chemical Co.	South Gate, Calif.	H_3PO_4
Pacific Coast Borax Co.	Boron, Calif.	H_3BO_3
Stauffer Chemical Co.	San Francisco, Calif.	H_2BO_3

*Does not include hydrochloric acid production or recovery, present or potential, of U. S. Vanadium Corp., Henderson, Nev., Pennsylvania Salt Mfg. Co. of Washington, Portland, Ore., Montrose Chemical Co., Henderson, Nev., Julius Hyman & Co., Denver, Colo., Colorado Fuel & Iron Corp., Denver, Colo., Hardesty Chemical Co., Henderson, Nev. †Primarily for own plant consumption.

PRODUCERS OF CAUSTIC SODA AND CHLORINE IN THE WEST

Company	Plant Location	Type of Cell	Year Built
Colorado Fuel & Iron Corp.[1]	Denver, Colo.	Hooker	1943
Clorox Chemical Co.	Oakland, Calif.	Whiting	....
Dow Chemical Co.[2]	Pittsburg, Calif.	Dow	1917
Hooker Electrochemical Co.[2]	Tacoma, Wash.	Hooker	1928
Iowa Soda Products Co.[3]	Rawlins, Wyo.	.....	....
Pennsylvania Salt Mfg. Co. of Wash.	Tacoma, Wash.	Gibbs	1928
	Portland, Ore.[6]	Gibbs	1947
Rayo Chemical Co.[4]	Los Angeles, Calif.	.....	1942
Stauffer Chemical Co.[5]	Henderson, Nev.	Hooker	1942

[1]Leased in early 1947 from Chemical Warfare Service, Rocky Mountain Arsenal. [2]Expansions under way or recently completed. [3]Intermittent small production of caustic soda, mostly for own consumption, by lime-soda process. [4]Recently ceased production. [5]Began operations in June 1947. [6]Operating approximately 50 percent of the caustic capacity of the former Basic Magnesium, Inc., units.

these facilities and operations are now probably under way. Part of the chlorine is used by Julius Hyman & Co. to produce chlordane insecticide, part will be used by Colorado Fuel & Iron Corp. for further processing of byproducts from the firm's Pueblo coke oven operations. Last of the new plants is that of Pennsylvania Salt Mfg. Co. of Washington at Portland, Ore., which began operations in June. This plant brings Pennsalt's total caustic-chlorine output in the Northwest to 200 tons daily. Part of the chlorine will be used by the firm to produce DDT at Portland.

Major expansion programs have been undertaken by Dow Chemical Co. at Pittsburg, Calif., and by Hooker Electrochemical Co. at Tacoma. A considerable percentage of chlorine output is used by both firms for producing chlorinated hydrocarbons, as much as 70 percent at the Dow plant.

New and increased demands for caustic soda have come from producers of pulp and paper, synthetic resins, amino compounds, synthetic detergents, chemical phosphates, vegetable and animal oils. A large potential use for caustic soda or ammonia is for the regeneration of synthetic resin ion exchangers in beet sugar factories; this will bear watching. In the case of chlorine, most significant development has been the increasing consumption for producing chlorinated organic chemicals (see section on halogenated hydrocarbons).

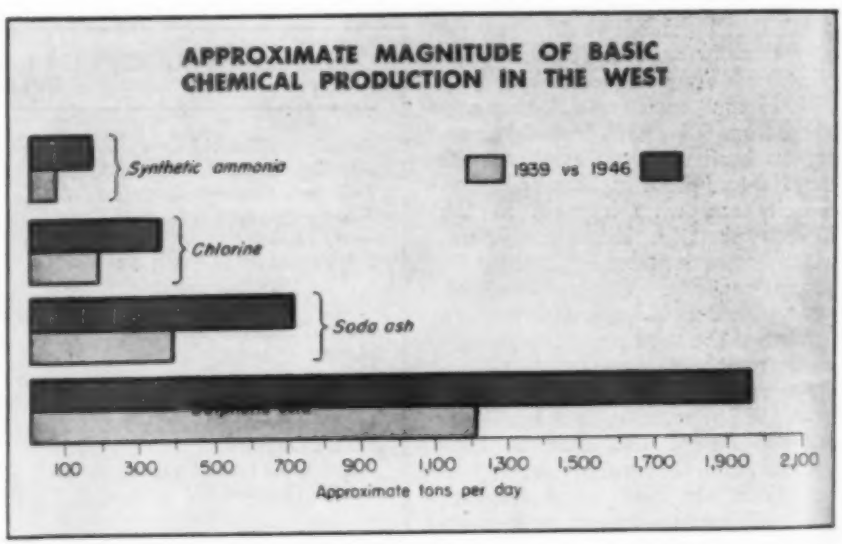
Soda Ash—In Seven Fat Years Nearly Doubles Tonnage

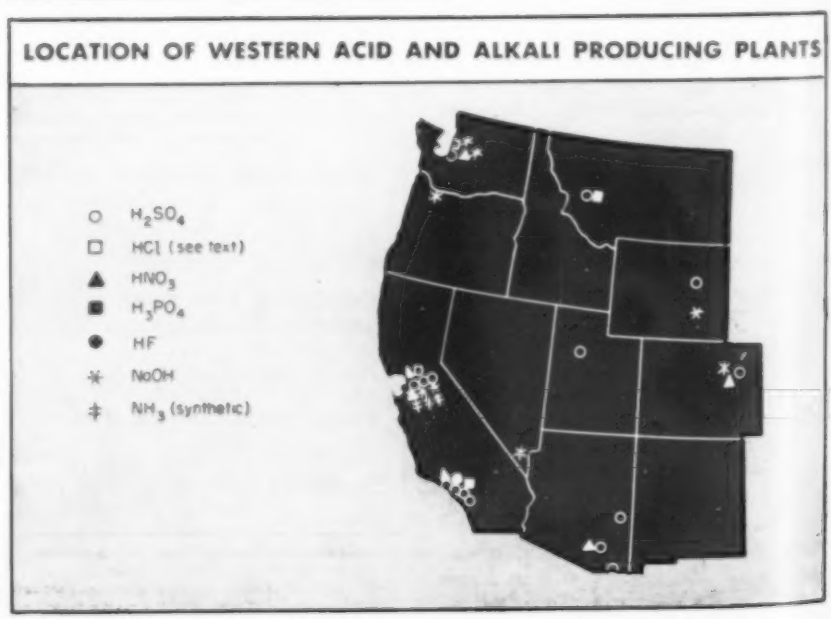
PRODUCTION of soda ash in the West, altogether from natural sources, has soared from approximately 120,000 tons in 1939 to 212,600 tons in 1946, an increase of about 77 percent. Last year the West produced almost six percent of the nation's output of this finished chemical. Considering the increased capacities of several present producers and the entry of two new producers into the field, 1947 production should approach 250,000 tons. By the end of 1948, total capacity (and probably production) should be 360,000 tons or more, including trona.

The two major soda ash producers in the West are American Potash & Chemical Corp. and West End Chemical Co. Output from the former has risen from 47,700 tons in 1939 to 86,300 tons in 1946, an increase of 80 percent. In addition, this firm has under way an expansion program scheduled for completion in 1948 that will increase soda ash capacity by an additional 70 percent and bring potential yearly output close to 150,000 tons. West End Chemical Co., also using Searles Lake brines, reported in 1946 an expansion of about 65-75 percent. In 1945, these two firms accounted for 85-90 percent of the soda ash output in the Western states. Wyandotte Chemicals Corp. also increased capacity in 1946.

Two new producers have entered the soda ash field in 1947. Permanente Metals Corp., operating on Owens Lake, began production early in the year after building a plant with a rated capacity of 100 tons daily. Output is now going exclusively to the Kaiser alumina plant at Baton Rouge, La. Now ready to begin production is the new operation of Westvaco Chlorine Products Corp. near Green River, Wyo. This firm, the only Western producer outside of California, will mine solid, high-purity trona from deposits some 1,200-1,500 ft. underground. Part of the output, initially reported to be planned at 60,000 tons annually, will be converted to soda ash.

Actually, consumption of soda ash in the West has increased at a higher rate than the increase in production, and less of the output is shipped east of the Rockies. Major expanded outlets consist of glass container manufacture (see section on glass), cleaning compounds, production of phosphates, silicates and other sodium salts, precipitation of magnesium carbonate from sea water, non-ferrous metallurgy,





iron and steel, sugar refining, and pulp and paper. At present, no soda ash is used in the area for producing caustic soda and bicarbonate. Within the next few years, increased usage will probably be largely concentrated in glass and related products, chemicals, sugar processing; eventual production of alumina from Oregon ferruginous bauxites would represent a new outlet.

Other Salines—California Wins in West, Shows in Nation

CALIFORNIA is the leading producer of salines (other than salt and soda) in the West, and one of the leaders in the nation. Borax and borates, produced altogether from this state, have increased from 244,800 tons (basis 40 percent anhydrous boric acid) in 1939 to 332,157 tons in 1946, a rise of 36 percent. American Potash & Chemical Corp. at Searles Lake, Calif., which turns out some 40 percent of total borax production in the United States, has an expansion program now under way that will increase the firm's capacity about 30 percent over the 1946 figure of 102,148 tons (borates and boric acids expressed as refined borax).

Salt cake and sodium sulphates are produced by two California firms, while Glaubers salt is made by two firms in Wyoming, mostly for stock feed purposes. American Potash & Chemical Corp. produces close to 17 percent of the national output of salt cake; this is used largely by kraft paper mills in the Northwest. The field of synthetic detergents represents a substantial new market for salt cake on the Pacific Coast. Sodium bisulphate is produced, but not from natural deposits, by Eston Chemicals, Inc., and by Globular Chemicals, Inc., both in Los Angeles.

Synthetic Ammonia—West May Exceed 300 Tons in '48

OUTPUT of synthetic ammonia in the West, all from California plants, reached the rate of about 160-180 tons daily by 1946, an increase of some 50 percent over that for 1939. With several expansions completed or projected, daily capacity should be upped to the neighborhood of 325-350 tons or more by the end of 1948. Such a figure would represent close to 10 percent of the present national total capacity for synthetic ammonia, including private and government plants.

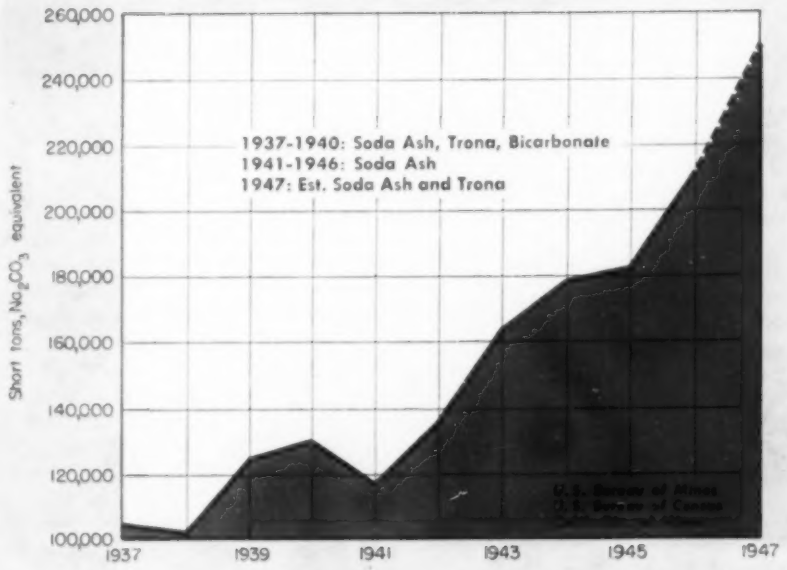
Producers are Shell Chemical Corp.

WESTERN PRODUCERS OF SODA ASH AND TRONA

Producer	Plant Location
American Potash & Chemical Corp.	Trona, Calif.
Columbia Chemical Div., Pittsburgh Plate Glass Co.*	Bartlett, Calif.
Permanente Metals Corp.	Lone Pine, Calif.
West End Chemical Co.	West End, Calif.
Westvaco Chlorine Products Corp.†	Green River, Wyo.
Wyandotte Chemicals Corp.*	Keeler, Calif.

*Also produce trona for sale. Output of trona by California producers in recent years has ranged from 1,000-15,000 tons annually. †Now about ready to begin mining of trona.

WESTERN PRODUCTION OF SODA ASH AND TRONA



PRODUCERS OF MISCELLANEOUS SALINES & SALTS*

Producer	Plant Location	Products
American Potash & Chemical Corp.	Trona, Calif.	Borates, salt cake, dessicated sodium sulphate
California Rock Salt Co.	Amboy, Calif.	Calcium chloride
Columbia Chemical Div., Pittsburgh Plate Glass Co.	Bartlett, Calif.	Borates
Desert Chemical Co.	Dale Lake, Calif.	Salt cake
Eston Chemicals, Inc.	Los Angeles, Calif.	Sodium bisulphate
Globular Chemicals, Inc.	Los Angeles, Calif.	Sodium bisulphate
Hill Bros. Chemical Co.	Amboy, Calif.	Calcium chloride
Iowa Soda Products Co.	Rawlings, Wyo.	Glaubers salt, salt cake
Los Angeles Chemical Co.	Los Angeles, Calif.	Calcium chloride
Miller & Zehrung	Portland, Ore.	Glaubers salt, sal soda
National Chlorides Co.	Amboy, Calif.	Calcium chloride
Pacific Coast Borax Co.	Kramer, Calif.	Borates
Pratt, Wm. E.	Casper, Wyo.	Glaubers salt
United States Borax Co.	Death Valley, Calif.	Borates
West End Chemical Co.	West End, Calif.	Borates

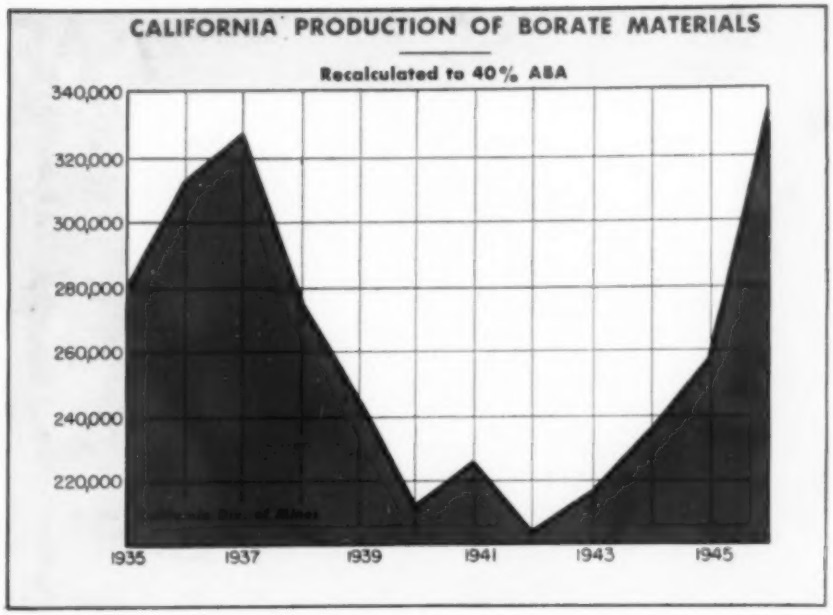
*Does not include soda ash and trona (see section on soda ash), salt or potash (see section on fertilizers).

at Shell Point, near Pittsburg, operating since 1931 and using natural gas as the source of hydrogen, Dow Chemical Co. at Pittsburg, operating since 1927 and using byproduct hydrogen, and Hercules Powder Co. at Hercules, which has been operating since 1939 and uses natural gas. The Shell plant, which has just been doubled in capacity and is scheduled for an additional 50 percent increase, is also a major producer of synthetic ammonium sulphate. Another firm is now doing experimental work on a thermal fixation process.

Major markets for ammonia in the West lie in agriculture, where it is used as ammonium sulphate or applied directly to irrigation water or the soil, in the manufacture of industrial explosives and chemicals, and for pulp processing at a new plant in the Northwest. A new outlet may possibly develop for the regeneration of synthetic ion exchangers in beet sugar factories. A considerable part of the output from Consolidated Mining & Smelting Co. at Trail, B. C., is used to produce fertilizer-grade ammonium sulphate, nitrate and phosphates.

Coal Chemicals—Supply and Demand Foster Exploitation

AT LAST there are definite signs on the horizon that the West's large and practically unexploited coal deposits will soon be tapped by the process industries—gently within the next few years, then more vigorously. These moves are backed by four factors: available reserves, especially in the Intermountain area; a keen demand for industrial carbon; markets for the chemical byproducts; new and improved processes.



In 1939, coal processing was largely represented by coke oven operations in Colorado and Utah. In that year there were 245 byproduct coke ovens in the West. With the building of the Geneva and Fontana steel plants, the number increased to 586 in 1945—a substantial increase for the area but still only 4 percent of the nation's ovens, and accounting for just 2.6 percent of the national output of byproduct coke. The ratio of beehive ovens is about the same.

In addition to the new byproduct chemicals output of Geneva and Fontana, for which there is a good demand, there is a substantial production of a similar line of products from petroleum sources by Portland Gas & Coke Co. and by Seattle Gas Co., both of which are making major expansions. Demand for some of these coke-oven chemicals is encouraging petroleum firms to enter the field. Xylol is produced by Oronite Chemical Co. while toluol and xylol are manufactured by Shell Chemical Corp. Byproduct phenol, ammonium sulphate and benzol are totally inadequate to meet demands; it is expected that benzol for chemical synthesis will soon be made available on a large scale from petroleum sources.

In the Northwest, where a cheap and high-grade industrial carbon is one of the urgent needs of the region, the Tacoma coke plant built during the war and operated (but never satisfactorily) by Wilkeson Products Co. has been sold to Consolidated Coal Mines, Inc., for production of coke and byproduct chemicals. Using Knowles ovens, the plant had a design capacity of 75,000 tons of coke annually. Crowns Nest Coal & Coke Co. at Fernie, B. C., has operated a new plant using Knowles ovens and having a capacity of 350 tons of coke per day. Research on the coke problem remains active in the Northwest.

Utah Chemical & Carbon Co. has announced plans to build a Lurgi process plant in Salt Lake City to make 235 tons of smokeless char daily and to produce chemicals, drugs and other substances from the coal tars. Incidentally, the coal-tar dyestuff, pharmaceutical and fine chem-

BYPRODUCT COKE OVEN PRODUCTION IN THE WEST[1]

	California		Colorado		Utah	
	1939	1945	1939	1945	1939	1945
Byproduct ovens, number	.....	90	189	188	56	308
Coke produced, 1,000 net tons[2]	.....	256.1	398.0	639.1	189.2	731.3
Tar produced, 1,000 gal	.....	4,604.5	6,576.1	10,265.0	3,728.3	15,119.3
Tar refined or topped, 1,000 gal[4]	.....	4,525.5	218.6[3]	10,351.3	3,757.1	5,467.7
Crude light oils produced, 1,000 gal	.....	1,477.6	2,034.9	3,215.1	1,342.7	5,516.8
Ammonium sulphate produced, 1,000 lb	.....	12,046.3	6,935.0	21,857.0	6,385.0	32,802.4

[1]U. S. Bureau of Mines. [2]Exclusive of breeze. [3]Only sales for this purpose. [4]Includes company operations and sales for this purpose.

icals industry is now practically (or entirely) non-existent in the West. At Wellington, Utah, the plant of Records Coal Processing Corp. began operations this summer. This unit, processing 100 tons of coal daily by using super-heated steam, will recover tar oils. Also in Utah, Americal Copal Co. at Huntington and Combined Metals Reduction Co. at Stockton have recently completed good-sized plants to extract fossil resins found in some Utah coals for the paint and varnish trade—a unique new industry in this country. Separation is made by sink-float and flotation, fractionation and purification by means of an organic solvent.

Some engineers believe that the Storrs low-temperature carbonization process, a new approach to coal treating, may prove to be one of the most important advances in the industry within a number of years. A new firm is now preparing to exploit the process on a large scale in Utah and elsewhere. Capable of producing a smokeless domestic fuel, a metallurgical-grade coke and a series of six or more relatively pure and distinct fractions of volatiles, this development may be the answer to the West's industrial carbon-coal chemicals problem.

WESTERN PRODUCERS OF HALOGENATED HYDROCARBONS[1]

Producer	Plant Location	Products
Arapahoe Chemicals, Inc.	Boulder, Colo.	Grignard reagents
Chemurgic Corp.[2]	Turlock, Calif.	Benzene hexachloride
Colorado Fuel & Iron Corp.[3]	Denver, Colo.	
Dow Chemical Co.[4]	Pittsburg, Calif.	Ethylene dibromide, dichloropropane, methyl chloride, methylene chloride, chloroform, carbon tetrachloride, perchlorethylene
Eston Chemicals, Inc.	Los Angeles, Calif.	Methyl chloride and bromide, ethyl chloride
Hardesty Chemical Co.	Henderson, Nev.	Chlorinated paraffins
Hooker-Detrex, Inc.	Tacoma, Wash.	Trichlorethylene
Julius Hyman & Co.[4]	Denver, Colo.	Chlordane
Montrose Chemical Co.	Henderson, Nev.	Chloral, monochlorbenzene, p-dichlorobenzene
	Torrance, Calif.	DDT
Pennsylvania Salt Mfg. Co. of Washington	Portland, Ore.	DDT
Shell Chemical Corp.[5]	Martinez, Calif.	Trichloropropane
Veith Chemical Co.[6]	Fresno, Calif.	2–4, dichlorophenoxyacetic acid
Westvaco Chlorine Products Corp.	Newark, Calif.	Ethylene dibromide

[1]Does not include products made from chlorinated intermediates but containing no chlorine in the final molecule. [2]Limited production at present. [3]Products, to be derived largely from coke oven byproduct processing, not yet announced. [4]Several proposed new products not yet announced. [5]Pilot plant or semi-commercial production. [6]Intermittent production.

Halogenated Hydrocarbons—Mark Industrial "Refinement"

Just as the sulphuric-alkali production-consumption index is barometric of basic chemical industrialization, so the halogen-derived organics index is becoming a guide to degree of advancement or "refinement" of an industrial economy. Organic chlorine compounds, in general, are not so much the "necessities" as the "semi-luxuries" of chemical process industry. Look at the West from this viewpoint—nothing is more indicative of the growing maturity of the region, chemical-wise.

Before the war, Dow Chemical Co. at Pittsburg, Calif., was the only major Western producer of chlorinated hydrocarbons. In spite of substantial expansions at this plant, these organics still consume close to 70 percent of the firm's output of chlorine. Now look at the accompanying table of present producers of halogenated hydrocarbons. Without any supporting figures, it is probably safe to say that the total halogenated hydrocarbons output of the West has increased three-fold in volume since 1939. Impelled by the necessity of finding new outlets for excess chlorine or the necessity of satisfying growing industrial demands, or both, the region is building up a relatively small but lusty chlorine-chemicals industry. There are well-founded indications that the industry has further expansions under consideration.

The chlorinated hydrocarbons industry of the West will doubtless gravitate to the major chlorine-producing centers of the area. Both Colorado Fuel & Iron Corp. and Julius Hyman & Co. have recently announced intentions of manufacturing a number of products centered around the caustic-chlorine facilities of the former CWS arsenal at Denver. The San Francisco Bay area has already become the region's most important organic chemicals producing area. Henderson, Nev., holds promise of becoming the chemical center of the Southwest, while there is continued interest in this field in the Northwest. New major markets for caustic soda may well accelerate development of the chlorinated hydrocarbons industry.

Other Organics—Pacific Producers Add Plants

Development of a healthy synthetic organic chemical industry requires markets large enough to warrant substantial operations and fixed capital investment, production and marketing

CERTAIN SYNTHETIC ORGANIC CHEMICALS NOT PRODUCED COMMERCIALLY IN THE WEST*

Acetic anhydride	Maleic anhydride
Aspirin	Nitrobenzene
Aniline	Nylon
Acetanilid	Oxalic acid
Dibutyl phthalate	Rayon
Ethylene glycol	Sulfa drugs
Ethyl ether	Synthetic vitamins
Ethyl acetate	Synthetic medicinals†
Freon	Synthetic phenol
Formic acid	Synthetic dyes†
Hexamethylenetetramine	Urea
Methanol	Vinyl acetate and chloride

*This list is not intended to be complete, but indicative only. †With minor exceptions.

know-how, a well-integrated raw materials and intermediates set-up. Like birds of a feather, synthetic organic operations usually roost in flocks.

Other than the well-known pioneering activities of Shell Chemical Corp. in petrochemical production, the Great Western Division of Dow Chemical Co. in the field of chlorinated hydrocarbons (see section on halogenated hydrocarbons), and Portland Gas & Coke Co. with petroleum coke byproducts, the prewar West had little production of synthetic organic chemicals. In spite of considerable activity since 1940, the region is still relatively adolescent in this respect; for a number of years, growth will be steady but not spectacular as in the Gulf Coast area. Among the organics that can reasonably be expected to go into new or expanded production in the area within the next five years are synthetic phenol, benzol, formaldehyde, acetic acid and acetates, synthetic detergents, methanol, amino compounds, certain solvents, resins and plastics raw materials, chlorine derivatives, synthetic insecticides and agricultural chemicals, coal-tar products, a few medicinals.

Largest newcomer to the region's synthetic organic field is the alert Oronite Chemical Co. which now produces phthalic anhydride from a petroleum base (a first in this respect), alkyl aryl sulphonate detergent (already one of the nation's largest producers), detergent intermediates, wetting agents, sodium sulphonates, organic mercaptans, polybutenes, ortho-, meta-, and para-xylenes and other products. Commercial Solvents Corp. produces acetic acid, formaldehyde (enlarged facilities in 1946), metaldehyde and formates. In 1946, Casein Co. of America began operations of a new formaldehyde plant in Oregon having a design capacity of 500 tons monthly. Cresylic acid is made by Shell Chemical Corp. and Oronite Chemical Co.; naphthenic acid and naphthenates by Oronite, Union Oil Co. of California and General Petroleum Corp. Union Oil also recently began manufacture of organic peroxides and mercaptans, especially methyl.

Styrene is made by Dow Chemical Co. in a government-owned plant at Los Angeles, butadiene at the same place by Southern California Gas Co., Shell Chemical Corp. and Standard Oil of California. The new monosodium glutamate plant, largest of its kind, of International Minerals & Chemical Corp. in California has just begun operations. Synthetic detergents or wetting agents have recently been put into production by Griffin Chemical Co. and Pacific Powder Co. Pacific Carbide & Alloys Co. has a semi-commercial plant in Portland to produce acetic acid from acetylene. Utah Chemical & Oil Co. recently began small-scale operations to produce chemicals from Utah bitumen-containing sands. For other new producers of synthetic and semi-synthetic organic chemicals, see sections on halogenated hydrocarbons, coal chemicals, insecticides, food processing.

Industrial Gases—Carbide Output of Prime Interest

Of the industrial gases, acetylene is probably most promising to the chemical imagination. More significant than the mere generation of the gas from calcium carbide, now being done by a large number of Western firms, is the primary production of the carbide itself: this requires a high-grade limestone, good coke and cheap electric energy. With probably the cheapest electric energy in the nation, the Pacific Northwest is the logical location for a carbide industry. In fact, the only two carbide producers in the West are already located in Portland—Pacific Carbide & Alloys Co. and Electro Metallurgical Corp. With a combined daily carbide production of about 80 tons in 1945, both firms are now undergoing substantial expansions. The solution to the coke problem is not altogether ideal, and good chemical-grade limestone is neither cheap nor easy to get. However, eventually an excellent limestone will probably be made available from the vast Alaskan deposits—this has been a promise.

Other than the manufacture of acetylene by a number of firms throughout the West, there are a considerable number of producers of other compressed and industrial gases (see table, also list of chlorine producers). Within the last three years, liquid SO_2 has developed a new substantial outlet for use in irrigation water to acidify alkaline soils. This treatment is being used throughout the Southwest.

Industrial Alcohol—Spirit Strong and Moves Northwest

With the nation, the West has seen a rapid change in its industrial alcohol technology and economy. Before the war, there were three major producers, all in California using molasses. At that time, productive capacity of the area was not over 6,000,000 gal. annually, and actual production probably not in excess of 4,500,000 gal. or close to three percent of the national total. With two large new plants, the industry has shifted toward the Northwest and total potential productive capacity of the Pacific Coast has increased to some 12,000,000 gal. annually. Other than pilot plant work, there is no production of alcohol from ethylene in the West nor is erection of such a plant likely in the near future.

The sulphite liquor alcohol plant in Bellingham, Wash., built during the war with a design capacity of 6,140 gal. of 190-proof product daily, and purchased early this year by Puget Sound Pulp & Timber Co., has since been operated at capacity and evidently at profit. The firm recently announced intentions of producing denatured alcohol. This plant is the only one of its kind in the United States.

PLANTS MANUFACTURING INDUSTRIAL GASES*

	CO_2 Liquid & Gas		Dry Ice		Hydrogen		Oxygen		SO_2 Liquid		Nitrous Oxide	
	1943	1946	1943	1946	1943	1946	1943	1946	1943	1946	1943	1946
Arizona	...	...	...	...	...	...	1	1	...	...	..	..
California	5	6	6	7	8	8	15	14	2	2	2	2
Colorado	1	1	1	1	...	...	3	3	...	...	..	..
Montana	...	...	..	...	...	...	1	1	...	...	..	..
Nevada	...	...	...	...	...	1	...	...	...	...	..	..
New Mexico	1	2	2	3	...	...	1	...	...	...	..	..
Oregon	...	...	...	1	...	...	5	4	...	...	..	..
Utah	2	2	1	1	1	1	2	3	...	1	..	..
Washington	1	2	2	2	3	3	6	5	...	...	..	..
Wyoming	...	...	...	...	...	...	1	1	...	...	..	..

*Units in production for 1943 and mid-1946. An additional oxygen plant under construction in Idaho. Not necessarily a complete listing. See also section on chlorine.

The much-discussed government-owned wood hydrolysis plant at Springfield, Ore., first of its kind on this continent, recently operated briefly two of its five percolators. With a design capacity of approximately 11,500 gal. daily, the unit will use weak H_2SO_4 hydrolysis of sawdust and other wood waste. Lignin and other byproducts will be all-important in the show-down economics of the operation, which is being watched with keen interest because of its potentialities to the Northwest. Willamette Valley Wood Chemical Co., composed largely of local lumbermen, has expressed interest in operating the plant after the Forestry Service demonstration try-out. At last reports, technological performance of the plant was mildly promising. Because of its vast implications to the forest products, organic chemicals and alcohol economy of the West, the ultimate fate of this guinea-pig plant will be significant, and certainly interesting. If and when turned over to the lumber interests, its future will become the acid test of the persistence, courage, progressiveness and research-mindedness of this industry.

Light Metals—In Heavy Output from Pacific Northwest

A LOT has happened since 1939 in the West's light metals industry, and the show isn't over yet. From possessing one manufacturer of aluminum in 1940, the Pacific Northwest has developed into one of the nation's leading producing centers for this metal, with five reduction plants capable of turning out 316,000 tons annually—twice the United States total prior to 1940. The answer lies largely in cheap power, since the region has no commercial production of bauxite or reduction-grade alumina. In spite of many dire predictions, every aluminum plant erected in the Northwest during the war is now committed to maximum operations by private industry. The total sums to 20 pot lines. The two reduction plants in California, however, have not fared so well and may never again be operated for their design purpose (see table of producers). Fabricating facilities are largely represented by the Trentwood, Wash., sheet mill of Permanente Metals Corp., the Vernon, Calif., extrusion mill of Aluminum Co. of America and the extrusion and tubing plant of Reynolds Metals Co. at Phoenix, Ariz.

Three experimental alumina plants were erected by the government during the war. None really ever got into satisfactory operations. The Salt Lake City unit of Kalunite, Inc., has been sold for other purposes; the Salem, Ore., unit of Columbia Metals Co. is producing ammonium sulphate after demonstrating technical feasibility of the alumina process. The firm still professes an interest in producing alumina from Oregon clay; economic commercial production is another matter. The Laramie, Wyo., unit of Monolith Portland Midwest Corp., to produce alumina from anorthosite shales as a means of beneficiating cement raw materials, has never operated. This process is probably the most economically promising of the various new methods for extracting alumina from non-bauxite materials.

Since the war's end, a lot of attention has been given to a source of reduction-grade alumina in the Northwest. Other than the Oregon clays, most work has been done on the extensive ferruginous bauxites of Oregon. Alcoa is continuing extensive exploration and experimental work to prove the so-called modified Pedersen process, which would produce pig iron as a byproduct. Although the results are not yet clear-cut, the consensus of Northwest opinion (and hopes) is that such a commercial operation will eventually be established in the area. Major results: further integration of the Northwest aluminum industry, repercussions in the area's chemical activities, stimulation to the ferrous metals field.

It now appears that the West will eventually have two magnesium producers—Permanente Metals Corp. at Permanente, Calif., and American Chrome & Magnesium Industries at Spokane, Wash. The Permanente plant, down since the war's end, will use a modified carbothermic (originally, Hansgirg) process. Considerable work has been done toward streamlining the process, and the firm has repeatedly stated its intentions of re-entering the field at an opportune time. American Chrome & Magne-

PRODUCERS OF INDUSTRIAL ALCOHOL IN THE WEST

Operator	Plant Location	Raw Material
Bonneville Distillers, Inc.[1]	Idaho Falls, Idaho	cull potatoes
Commercial Solvents Corp	Agnew, Calif.	molasses
Lac Chemicals, Inc	Culver City, Calif.	molasses
Puget Sound Pulp & Timber Co	Bellingham, Wash.	sulphite liquor
U. S. Industrial Chemicals, Inc	Anaheim, Calif.	molasses
Willamette Valley Wood Chemical Co.[2]	Springfield, Ore.	wood waste

[1]Also beverage-grade alcohol from cull potatoes and grain. [2]Government-owned. Recently began demonstration operations under sponsorship of the U. S. Forestry Service.

LIGHT METALS PLANTS IN THE WEST

Operator	Plant Location	Rated capacity, Lb. per Year
Aluminum		
Aluminum Co. of America	Vancouver, Wash.	172,000,000
Permanente Metals Corp	Mead, Wash.	216,000,000
	Tacoma, Wash.	41,000,000
Reynolds Metals Co	Longview, Wash.	62,000,000
	Troutdale, Ore.[1]	144,000,000
Total active capacity		635,000,000
None	Riverbank, Calif.	108,000,000
None	Torrance, Calif.	180,000,000
Alumina		
Columbia Metals Co. (down)[2]	Salem, Ore.	36,000,000
Monolith Portland Midwest Corp. (down)	Laramie, Wyo.	36,000,000
Magnesium		
American Chrome & Magnesium Industries (p.p.)[3]	Spokane, Wash.	[5]48,000,000
Permanente Metals Corp. (down)[4]	Permanente, Calif.	[5]24,000,000

[1]Temporarily closed down. [2]Now producing ammonium sulphate. [3]Ready to begin pilot plant operations prior to leasing. [4]Process being streamlined. [5]Original design capacity.

sium Industries wishes to buy the Spokane ferrosilicon magnesium facilities to produce this metal by a modified process for use in manufacturing lightweight reels. WAA has stipulated that the sale could be arranged if the firm would demonstrate the technical and economic feasibility of its process by pilot plant operations in the Spokane units. The firm is now conforming with this suggestion.

Magnesium Products—Coast Still Leads Nation

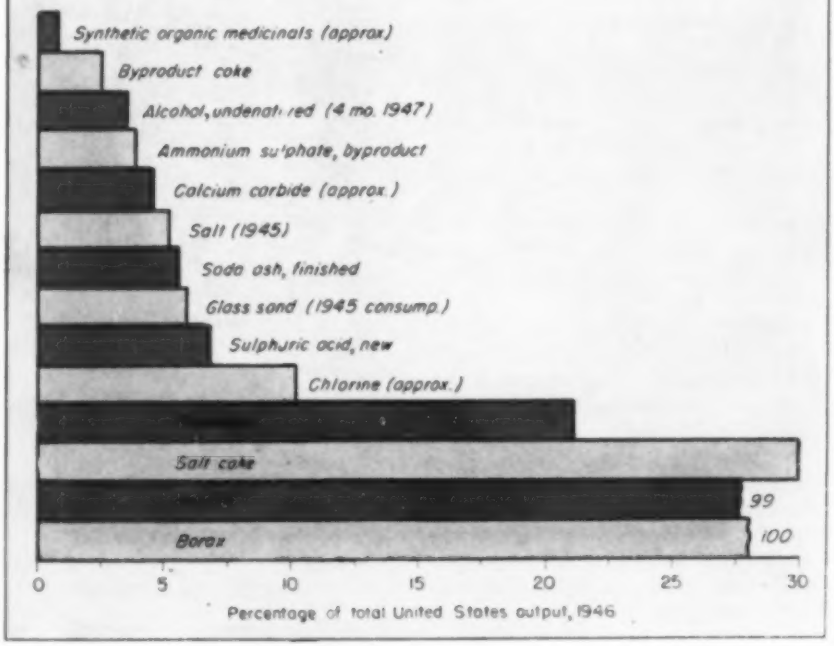
MAGNESIA-WISE, the Pacific Coast has been a leader in the nation. Marine Magnesium Products Corp. at South San Francisco was the first commercial producer of magnesium salts from sea water; products now include magnesium carbonate (U.S.P. and technical), oxide (light, heavy and medium), oxide and carbonate, magnesium hydroxide (dry and paste).

With 65 percent of the national output of refractory magnesia in 1944, Northwest Magnesite Co. at Chewelah, Wash., is the largest domestic producer of this material. The company has more than doubled its capacity since 1939. About 75 percent of the crude magnesite produced in the United States in the prewar period came from the state of Washington; Northwest continues to control the output of magnesite and dead-burned magnesia in that state. Newcomer to the magnesia refractory brick business, the Permanente Cement Co. began production in 1946 of a high-purity periclase product, with a capacity of 100 tons daily, on the shores of Monterey Bay, near Watsonville, Calif. The plant obtains magnesia from the seawater process of near-by Permanente Metals Corp. at Moss Landing and dolomite from Natividad.

Westvaco Chlorine Products Corp. at Newark, Calif., continues as the major domestic producer of caustic calcined magnesia and of periclase-grade refractory magnesia. The caustic calcined product is used chiefly in oxychloride cement for plastic floorings.

Output of 85 percent magnesia insulation in the West is limited to Johns-Manville Corp. at Redwood City, Calif., and Plant Rubber & Asbestos Div. of Paraffine Cos., Inc., at Redwood City and Emeryville, Calif. Developments by the latter firm in this field since 1939 are looked upon by some engineers as the most outstanding in the magnesia insulation field within many decades.

Estimated Participation of the West in Certain Segments of the National Chemical Production Economy. As approximate percentage of total 1946 production unless otherwise noted



Organic Medicinals—Orient May Provide Needed Markets

INEVITABLY, the trend of the medicinal field is toward synthetic organics. Of approximately 600 such synthetic organic medicinals produced commercially in the nation, the West produces at the most (by stretching the definition) not more than five or six. The reasons are logical: relative youthfulness of the area, lack of a coal-tar chemicals industry, early concentration of technology and facilities on the Atlantic Seaboard, small-magnitude markets. With increasing western population and opportunities for exports to the Orient, the conventional logic may be soon out of date, especially in respect to total drug and pharmaceutical products.

Recent moves of the industry to the Pacific Coast include those of McKesson & Robbins, Inc., to Portland, Rexall Drug Co. to Los Angeles, and Harrower Laboratories, Inc., to Glendale, the latter two in 1947. Julius Hyman & Co. has just announced plans to produce drugs and antibiotics in part of the former CWS facilities at Denver. Penicillin is produced by Cutter Laboratories in Berkeley, oldest and largest biologicals firm west of Chicago; output has been expanded well over 10-fold in recent years and a number of new penicillin products are coming from this firm's laboratories. Cutter has also been the pioneer commercial producer in this country of a series of valuable protein fractions derived from human blood. Van Camp Laboratories at Terminal Island, Calif., is doing pioneering work in the production of amino and related compounds from fish and fish byproducts. Bioproducts Oreg., Ltd., near Astoria, is active in a related field. International Minerals & Chemical Corp., now beginning operations at San Jose, Calif., will probably soon produce pharmaceutical products such as betaine hydrochloric and tyrosine.

There seems to be a good opportunity, as yet hardly mentioned, of fostering a domestic essential oil and medicinal herbs industry in the San Diego region, which has a Mediterranean-type climate ideal for certain such valuable flora. The Pacific Coast is certainly the nation's leading producer of vitamins A and D from shark and halibut liver oils, but there are no molecular distillation units along the entire coast. No synthetic vitamins are produced west of the Mississippi Valley.

CHEMICALS PRODUCED COMMERCIALLY IN THE WEST SINCE 1941[1]

Chemical	Producer	Plant Location
Alkyl aryl sulphonate (detergent)	Oronite Chemical Co	Richmond, Calif.
Aluminum[2]	Aluminum Co. of America	Vancouver, Wash.
	Reynolds Metals Co	Longview, Wash.; Troutdale, Ore.
	Permanente Metals Corp	Mead, Tacoma, Wash.
Aluminum chloride, anhyd	Hooker Electrochemical Co	Tacoma, Wash.
	New York-Ohio Chemical Co	Henderson, Nev.
Amino compounds[3]	Van Camp Laboratories	Terminal Island, Calif.
Ammonium para-tungstate	U. S. Vanadium Corp	Henderson, Nev.
Benzene hexachloride[4]	Chemurgic Corp	Turlock, Calif.
Blood proteins	Cutter Laboratories	Berkeley, Calif.
Butadiene	Standard Oil Co. of Calif	Los Angeles, Calif.
Calcium carbide[2]	Electro Metallurgical Corp	Portland, Ore.
	Pacific Carbide & Alloys Co	Portland, Ore.
Chloral	Montrose Chemical Co. of Calif	Henderson, Nev.
Chlordane	Julius Hyman & Co	Denver, Colo.
DDT	Montrose Chemical Co. of Calif	Torrance, Calif.
	Pennsylvania Salt Mfg. Co. of Wash	Portland, Ore.
2, 4-Dichlorophenoxyacetic acid	Veith Chemical Co	Fresno, Calif.
Dichlorobenzene	Montrose Chemical Co	Henderson, Nev.
Dilithium monophosphate	American Potash & Chemical Corp	Trona, Calif.
Dimethyl sulfolane[4]	Shell Chemical Corp	Martinez, Calif.
Ethyl chloride	Eston Chemicals, Inc	Vernon, Calif.
Fossil resins, purified	American Copal Co	Huntington, Utah
	Combined Metals Reduction Co	Stockton, Utah
Formaldehyde	Casein Co. of America	Springfield, Ore.
	Commercial Solvents Corp	Agnew, Calif.
Hexaethyl tetraphosphate	Eston Chemicals, Inc	Vernon, Calif.
Hydrofluoric acid	General Chemical Co	El Segundo, Calif.
Hexylene glycol[4]	Shell Chemical Corp	Martinez, Calif.
Iron, powdered	Tacoma Powdered Metals Co	Tacoma, Wash.
Manganese sulphate	Western Electrochemical Co	Henderson, Nev.
Methyl magnesium bromide (Grignard)	Arapahoe Chemicals, Inc	Boulder, Colo.
Monosodium glutamate	International Minerals & Chemicals Corp	San Jose, Calif.
Monosodium phosphate, anhyd	Maas Chemical Co	South Gate, Calif.
Organic peroxides (petroleum)	Union Oil Co. of Calif	Wilmington, Calif.
Paraffin waxes, high-melting	Union Oil Co. of Calif	Oleum, Calif.
Penicillin	Cutter Laboratories	Berkeley, Calif.
Phenyl magnesium bromide (Grignard)	Arapahoe Chemicals, Inc	Boulder, Colo.
Phosphoric acid, 75 & 85 percent	Maas Chemical Co	South Gate, Calif.
Phosphatic fertilizer, fused	Permanente Metals Corp	Permanente, Calif.
Phthalic anhydride	Oronite Chemical Co	Richmond, Calif.
Polybutenes	Oronite Chemical Co	Richmond, Calif.
Potassium chlorate	Pennsylvania Salt Mfg. Co. of Wash	Portland, Ore.
	Western Electrochemical Co	Henderson, Nev.
Potassium metabisulphite	Eston Chemicals, Inc	Vernon, Calif.
Potassium perchlorate	Western Electrochemical Co	Henderson, Nev.
Resin ion exchangers, syn	Chemical Process Co	Millbrae, Calif.
Sodium acid pyrophosphate	Maas Chemical Co	South Gate, Calif.
Sodium fluoride & bifluoride	General Chemical Co	El Segundo, Calif.
Sodium chlorate	Pennsylvania Salt Mfg. Co. of Wash	Portland, Ore.
Sodium thiosulphate, anhyd	Maas Chemical Co	South Gate, Calif.
Strontium hydrate	Westvaco Chlorine Products Corp	Modesto, Calif.
Styrene	Dow Chemical Co	Gardena, Calif.
Tetrasodium pyrophosphate	Maas Chemical Co	South Gate, Calif.
Trichlorethylene	Hooker-Detrex, Inc	Tacoma, Wash.
Trisodium phosphate, anhyd	Maas Chemical Co	South Gate, Calif.
Xylenes, ortho-, meta-[4] & para-[4]	Oronite Chemical Co	Richmond, Calif.

[1]Includes only primary producers. Not necessarily a complete listing. [2]First produced in 1940 in the West. [3]Certain amino acids and related compounds derived largely from fish. [4]In pilot plant, semi-commercial or limited commercial production.

CHEMICAL CONSUMING INDUSTRIES

Food Processing—Chemurgy Looms Large for Future

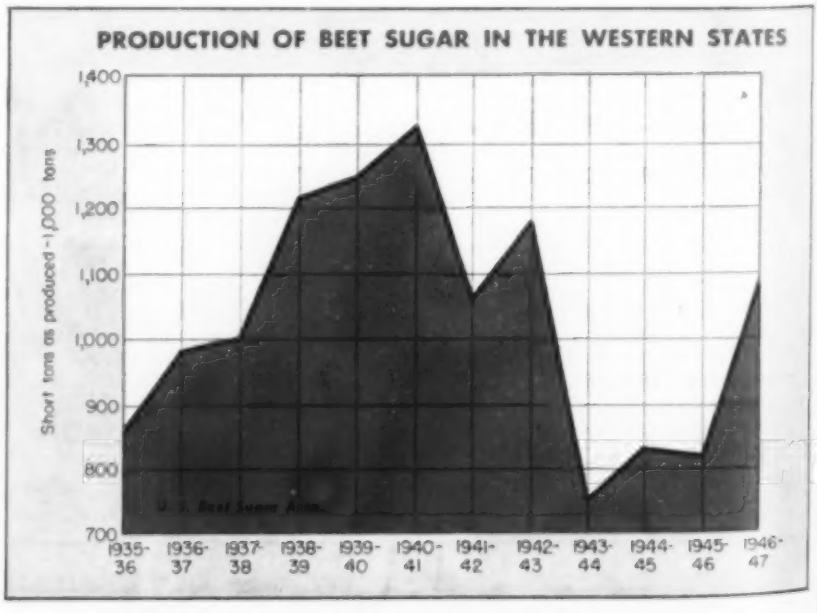
PROCESSING of food and related products was the West Coast's leading manufacturing industry in 1939, when the value of its products was 22 percent of the total of all products for the area and 11 percent of the national output for this industry category. Since that year, activity has increased some 20-25 percent, as measured in terms of average wage-earner employment for 1946, but the relative position of the industry has fallen in spite of increased output. Quick-freezing of fruits and vegetables in California expanded output over 15-fold since 1940. Producing nearly half the commercial fruit and one fourth of the vegetables of the nation, California agricultural and food processing industries operate on a large-scale basis. Because of the chemicals used in the bleaching, preservation, fumigation, refrigeration and other phases of food and beverage processing, this industry supports (directly or obliquely) a considerable portion of the chemical operations of the West. Usage of chemicals can be expected to increase, but not dramatically.

There is evidently an opportunity in the West, paralleled in few other parts of the world, for the greater chemurgic utilization of agricultural and food processing byproducts. Raw materials are usually plentiful, frequently concentrated in small areas. However, it is axiomatic that chemurgic ventures are often hazardous: technically feasible, economically ticklish. More sound activity in this field is highly desirable in order to help stabilize the nation's agricultural economy, to integrate better the chemical and process industry set-up of the region, and to aid in solving the waste disposal problems that are becoming increasingly acute in certain areas of the West. The Western Regional Research Laboratory of the U. S. Dept. of Agriculture and other organizations are pioneering research in the field. Oregon, Washington and Idaho are probably the leaders in recognizing early the show-down with chemurgy that the agriculture of the nation may some day have to face, as a whole or by sections.

War and postwar advances of the area in chemurgy are numerous, although some are probably shaky; establishment of a domestic tartrate industry in the wineries of California (hard hit in 1946); a white potato starch industry from cull potatoes in Idaho (10,000 tons of starch this year from four plants); more citric acid, sodium citrate, pectin and other products from California citrus wastes; amino acid and other chemicals from fish scrap; alcohol from cull potatoes and wheat in the Northwest; starch, glucose and dextrose from Washington and Oregon potatoes and wheat, led by Northwest Chemurgy Coop. and Berger-Kreuger, Inc.; yeast from sulphite liquor to supply badly needed high-protein materials for stock feed; asparagus butt juice concentrate as an antibiotics culture medium; wines from fruits and berries. The list should be extended.

Sugar—Revolution Brewing, Repercussions Expected

WESTERN beet sugar refineries have, for many years, been producing close to three-quarters of the nation's output of this commodity; the figure is estimated at 75 percent for 1946-47. The West's production, close to 1,100,000 short tons for the last season, is back to the prewar rate with Cal-



ifornia and Colorado in the lead. New plant capacity added in the area since 1936 amounts to about five percent of the national total capacity; increased operating capacity has been more.

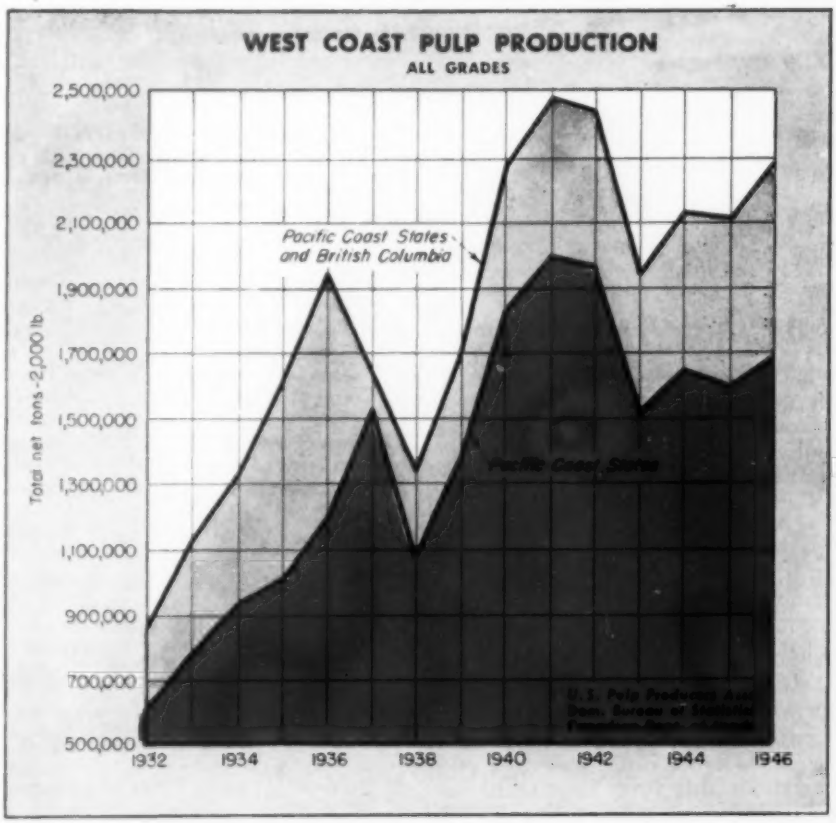
There is little doubt, the sugar beet and beet sugar technologies are in sight of a potential revolution. Contributing factors include significant strides in the mechanization of seeding, planting and harvesting; development of a continuous diffuser that increases beet slicing capacity by 20 percent, raises the sugar yield and lowers processing labor costs; increasing application of automatic control devices; the possible large-scale switch to synthetic resin ion exchangers that would have repercussions in the domestic molasses, alcohol and chemical economies. Final outcome is not yet certain, but most progress reports are promising. Meanwhile, research continues toward developing more industrial products from beet byproducts.

If the beet sugar refineries (there are 53 in the West) should convert even on a moderate scale to the use of ion exchangers (see *Chem. Eng.*, July 1947) the impact on the acid-alkali industries of the West would certainly be felt. Amalgamated Sugar Co., Hawaiian Pineapple Co. and Holly Sugar Co. are already installing commercial ion exchange units (see table).

The Pacific Coast also has a substantial cane sugar industry that refines a high percentage of the Hawaiian and Philippine raw sugar output. One of these plants, located on San Francisco Bay, is rated as the largest individual sugar refinery in the world. Their combined output is probably close to a fifth of the total from all United States refineries.

SYNTHETIC RESIN ION EXCHANGER INSTALLATIONS IN THE WESTERN SUGAR AND RELATED FIELDS

Firm	Plant Location	Status
Amalgamated Sugar Co.	Burley, Idaho	P.p. and semi-comm.
Amalgamated Sugar Co.	Twin Falls, Idaho	Com'l; beginning operations
Hawaiian Pineapple Co.	Honolulu, Hawaii	Com'l; operating
Holly Sugar Co.	Alvarado, Calif.	Pilot plant
Holly Sugar Co.	Holly, Mont.	Com'l; under constr.
Oahu Sugar Co.	Oaho, Hawaii	Pilot plant
Union Sugar Co.	Betteravia, Calif.	Pilot plant



Pulp, Paper — Wood, Chemical Industries March Arm in Arm

For two or more decades, the Pacific Coast pulp industry has maintained its relatively high position as a pulp-producing area of the nation—19 percent of total production of all grades in 1931, then 20 percent in 1939 and back to 16 percent in 1946. Yet the area's total production increased 104 percent in this 16-year period and 35 percent since 1939. These states turned out 37 percent of the total bleached sulphite and 42 percent of unbleached sulphite last year (see table). These figures do not include the substantial and growing output of British Columbia.

More significantly, such performance data do not include postwar

PACIFIC COAST PULP CAPACITY AND PRODUCTION, 1946*

Type	Normal capacity		Production	
	Tons	Percent U. S. Total	Tons	Percent U. S. Total
Bleached sulphite	756,832	40	632,649	37
Unbleached sulphite	434,149	42	329,027	42
Bleached sulphate	95,780	12	71,360	9
Semi-bleached sulphate	32,300	22	.....	..
Unbleached sulphate	341,520	8	327,862	9
Soda	9,360	2	.....	..
Semichemical	39,270	10	.....	..
Groundwood	333,763	15	312,028	17
Total all types	2,042,974	18	1,694,959	16

*Does not include British Columbia. U. S. Pulp Producers Assn.

expansions that will largely materialize this year and in 1948. These will add close to 12 percent to Northwest capacity, mostly in Washington and California, and some 40 percent to British Columbia capacity. Nor do they include major expansion moves just recently announced.

Among the firms that have large expansions under way are Crown Zellerbach Corp., Weyerhaeuser Timber Co., Puget Sound Pulp & Timber Co., Fibreboard Products Corp., Rayonier, Inc., and St. Regis Paper Co. Celanese Corp. of America is beginning construction of facilities near Port Edward, B. C., to produce initially some 250 tons daily of rayon-grade pulp. Eventually output may go up to 400 tons daily—about 25 percent of the present United States and Canadian production of this grade of cellulose. Big news was heard in July when the way was cleared for use of the government's vast timber reserves in Alaska. Already there is talk that some five mills, representing an investment of several hundred million dollars, may be established in that area. All such moves, of course, mean more chemicals from West Coast plants.

In chemical technology, most interesting postwar developments are the new ammonia pulping process at the Shelton, Wash., plant of Rayonier, Inc., and the magnesia-base process at the Longview, Wash., plant of Weyerhaeuser Timber Co., which goes into operations this year. Significant developments are taking place in sulphite liquor utilization, waste bark processing, sawdust and wood waste treatment to produce profitable by-products. Research along all lines is intense. The future of the entire Northwest forest products industries is becoming increasingly linked with the chemical industries; the reverse is obviously true.

Also scoring major advances on the Pacific Coast are the paper and paper products industries. Employment in these industries in California alone has already increased nearly 50 percent since 1939. New paper capacity to come in within the next few years totals over 1,700 tons daily on the Coast and British Columbia. The West Coast paper products field, especially in that of containers, is making the biggest expansion moves in its entire history.

Plywood—Demand High, But Problems Plague Producers

SOFTWOOD plywood, of which the Pacific Northwest produces about 99 percent of the national total in 36 mills, is a booming industry beset with many difficulties—limited log supply, shortage of certain glues, scarcity of hot presses and sanding machines, high prices, increasing competition. Demand is still far ahead of supply. The industry is trying to meet the challenge by increasing production, up-grading low-quality basic materials, maintaining high standards, developing new products, stimulating a more ample supply of phenolic glues. The issue is joined—time will tell.

Output for 1947 will approach 1.6 million sq. ft., an increase of about 14 per cent over last year, 235 percent over 1935 and more than 1,000 percent over 1925. Some five mills now under construction in the Northwest and California will add about 6-8 percent to output in 1948. Largest of the new plants are those of Weyerhaeuser Timber Co. at Longview, Wash., and Harbor Plywood Corp. at Hoquiam, Wash., with a combined capacity of close to 175 million sq. ft. annually. Some 97 percent of softwood plywood is made from Douglas fir, the remainder from Ponderosa pine.

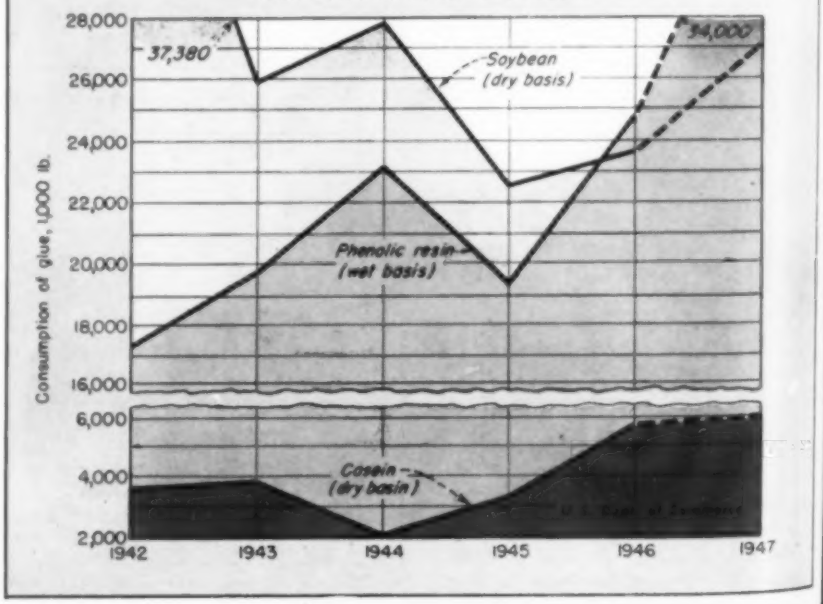
This industry is of vital importance to Northwest chemical economy since

PRODUCERS OF PLYWOOD AND RELATED ADHESIVES IN THE NORTHWEST[1]

Firm	Plant Location	Type of Products
Adhesive Products Co.[2]	Seattle, Wash.	Soybean, casein, phenolic
American-Marietta Co.[2]	Vancouver, B. C.	Soybean, casein, phenolic
Monsanto Chemical Co. (Laucks Div.)[3]	Seattle, Wash.	Soybean, casein, phenolic, urea, resorcinol, melamine
Balfour-Guthrie, Ltd	Tacoma, Wash.	Soybean, casein
Casein Co. of America	Seattle, Wash. Springfield, Ore.	Soybean, casein, phenolic, urea, resorcinol, melamine
Harbor Plywood Corp.[4]	Hoquiam, Wash.	Soybean, casein, urea
M & M Woodworking Co.[4]	Portland, Ore.	Soybean, casein, phenolic
Reichhold Chemicals, Inc.[5]	Seattle, Wash.	Phenolic, urea, melamine, alkyds
Monsanto, Ltd.	Vancouver, B. C.	Phenolic, urea, melamine, casein, soybean
United States Plywood Corp.[6]	Portland, Ore.	Phenolic

[1]As of July, 1947. [2]Now Adhesive, Resin & Chemical Div. of American-Marietta Co. [3]Includes products to be made in expanded facilities now under construction. [4]Largely for own use. [5]New plant began operations in 1947. [6]New plant to begin operations in 1947.

CONSUMPTION OF GLUE IN SOFTWOOD PLYWOOD



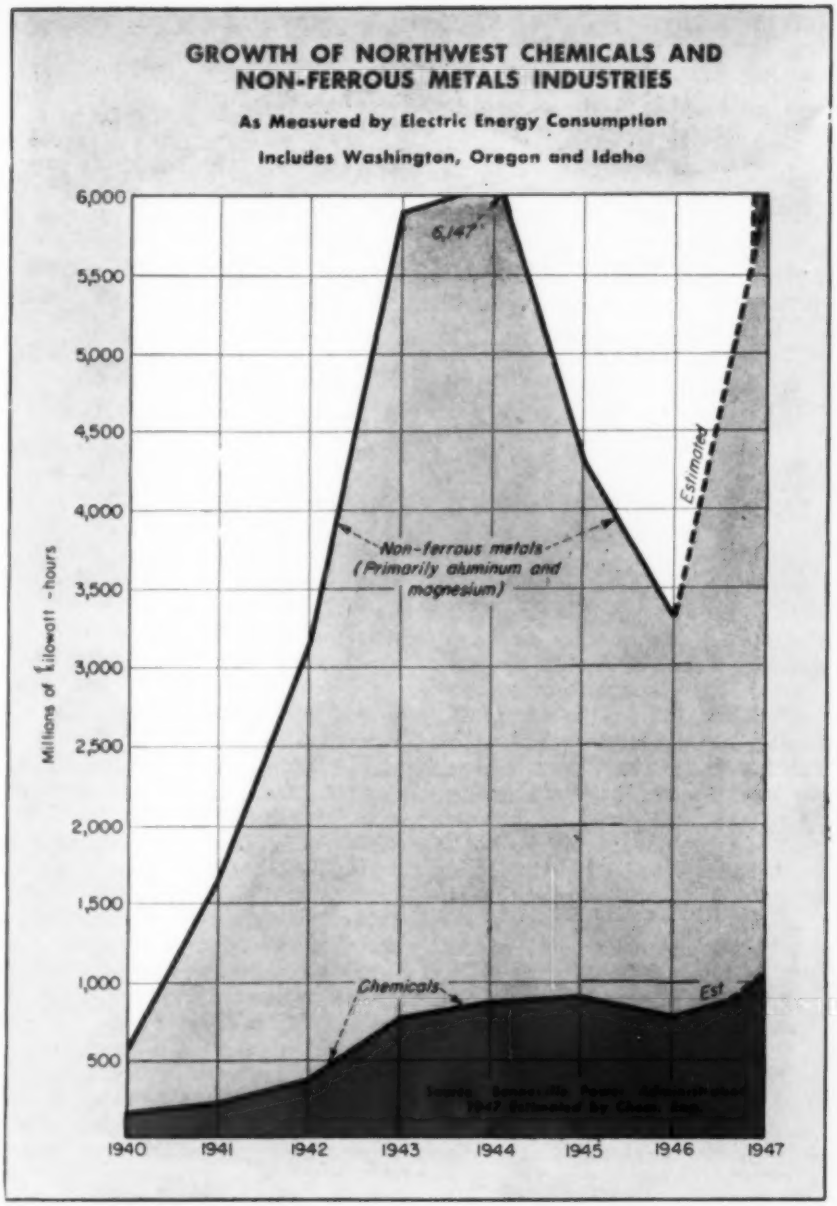
it is a large consumer of glues and hence of all the chemicals that go into their manufacture. Total glue consumption in 1946 was 56 million pounds, mostly phenolic, soybean and casein, in order of importance (see chart). In 1942, exterior-type plywood (using mostly phenolic glues) accounted for 15 percent of the total production; this rose to 30 percent in 1946 and possibly 35 percent in 1947 or about a six-fold increase since 1941. Consumption of phenolic resins (now at about the rate of 12,000,000 lb. of phenol annually in the Northwest and British Columbia) would increase 75 percent or more if the resins were readily available. In answer to this challenge, synthetic phenol will probably be produced in the area as soon as the benzol raw material situation is clarified. Such a move would help stabilize the plywood and adhesives industries as well as bolster the chlorine-caustic or sulphuric acid, formaldehyde, and possibly methanol economy of the West. The situation is about ripe for action. In addition, the plastic-veneer, overlay and impregnates industry (paper, plywood or wood waste) is in its infancy, shows promising possibilities. The chemicals-resins-veneer combine of the Pacific Northwest has a future, possibly led by the progressive Plywood Research Foundation and the chemical research laboratories of the region.

Alertness of the glue and resins industries of the Northwest is shown by the recent major expansions of Monsanto Chemical Co., Reichhold Chemicals, Inc., Adhesive Products Co. (now American-Marietta Co.), United States Plywood Corp., and Casein Co. of America (see table).

Iron and Steel—Coast Now Achieves Integration

Because of its long-range importance to the chemical, chemical equipment and process industries of the region, the progress of the West's basic iron and steel industry is worth watching. Growth of these industries since 1939, when the area had 2.7 percent of the national steel ingot capacity, is a major point of pride with Westerners. Now with some five percent of the nation's capacity, the region is attaining for the first time in its history an integrated steel industry.

With increased ingot capacity and new or enlarged facilities for tubular products, sheet and tin plate, rods and bars, the West's basic steel industry will soon be in a position to supply many primary products needed by fabricating plants. A recent cut in



NUMBER OF WESTERN EQUIPMENT MANUFACTURING PLANTS*

	Total in United States	Total in West
Ball & roller bearings	34	....
Chemical machinery & equipment	22	....
Conveying equipment	43	6
Blowers, exhausts & ventilating fans	32	3
Generators & electric motors	81	6
Heat exchangers	15	1
Industrial furnaces & ovens	22	1
Mechanical measuring instruments	55	6
Professional & scientific instruments	24	2
Pumps & compressors	126	16
Steel shipping barrels, drums & pails	52	6
Valves, faucets & fittings	145	11
Wiring devices & supplies	79	5
Fabricated metal-products†	6,916	549

*First half of 1946. From U. S. Bureau of the Census. Estimated coverage ranges from 75-95 percent of the entire industries. †Based on 6,916 of the nation's largest plants.

freight rates from Geneva to Pacific Coast points is considered another victory against high steel costs. The present output comes from 57 open-hearth furnaces and five electric furnaces. The West can now produce 2,600,000 net tons of pig iron annually. Within the last two years in California alone, over $50 million has been invested in new and expanded plant facilities to produce iron, steel and their products (exclusive of machinery).

Other than their oblique stimulation to the consumption of chemicals, these moves will add up (but probably not as quickly as some persons expect) to a major change in the structure of the process machinery and equipment industries of the West. Today, assurance of adequate steel supplies is often the major factor in decisions to locate metalworking branch plants in the West. Slowly but surely, more basic and standard equipment items will be manufactured locally, chiefly in California, the Pacific Northwest and Utah, while specialty items will largely continue to come from localities where they can be manufactured most conveniently and economically.

It is significant to note that since 1939 the California electrical machinery and equipment industry has grown, wage-earner-wise, some 175 percent, that the other machinery (except electrical) field has increased close to 190 percent and now represents an estimated five percent of the national value output of the industry as compared with 3.2 percent in 1939.

In related fields, advances have been made in the ferro-alloys industry, represented by Electro Metallurgical Corp. in Portland and Ohio Ferro-Alloys Co. in Tacoma, which produces ferro-chrome. An alloys pilot plant, largely using local raw materials, is under way at Shasta Dam. Powdered iron is produced, by a significant new electrolytic process, by Tacoma Powdered Metals Co. The product is shipped East.

Petroleum and Natural Gas—Demand Up, Reserves Down

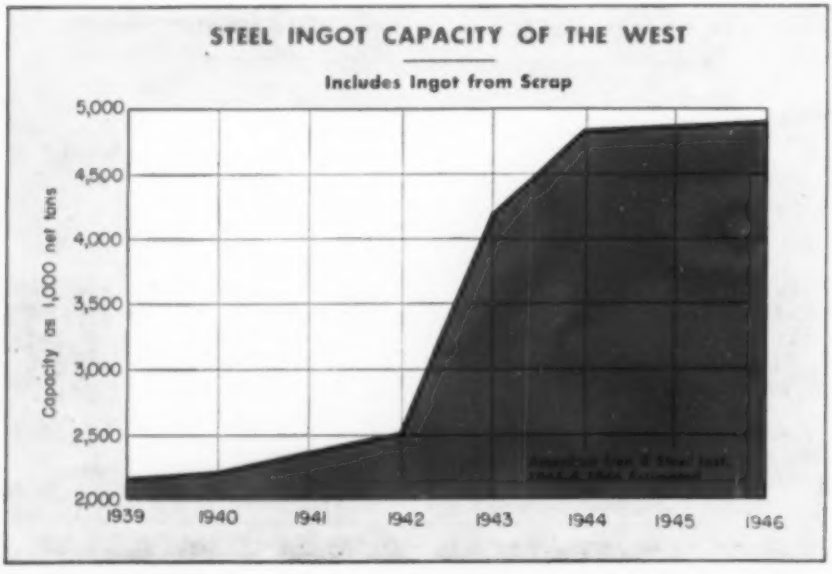
INCREASING demands for petroleum products that are expected to continue over a long period, possibility of declining crude reserves in the near future—these are the basic problems facing the West Coast petroleum and natural gas interests. In relation to the national total, Western production of crude oil increased from 22 percent in 1937 to 24 percent in 1946 while proven reserves fell from 27 to 23 percent.

The West already has over 16 percent of the nation's registered motor vehicles, and California leads all states in gasoline consumption. A continued long-term population increase and the liberal driving habits of most Westerners will tend to keep motor fuel consumption at a high level. On the other hand, there have been no major discoveries of new fields on the Pacific Coast within the past ten years. California, meanwhile, continues its high rate of crude production (over 18 percent of the United States output for 1946), and output from the intermountain states, chiefly Colorado and Wyoming, has increased. Development of the Rangely field in Colorado has been the West's most important oil discovery since 1939. The result is that the West has inched up its share of the nation's total crude output from 22.9 percent in 1939 to 23.6 percent in 1946.

For the next decade or so, crude for the big refineries of the West will probably be assured by large present proven reserves of the area, new fields that may result from more intensive exploration programs, increased output resulting from improved production methods and deeper drilling (which shows some promise in southern California), further development of fields in the intermountain area, increasing imports by water and by pipeline from the Southwest. A 20-in. line from Texas to the Los Angeles area is already reported to be planned by a group of firms headed by Shell. While the situation is by no means alarming, it is obvious that the problems of the Western oil industry are becoming more complicated and difficult.

Thus it is evident that the large refining operations on the Pacific Coast, chiefly centered in the Los Angeles and San Francisco areas, will be continued and possibly increased. In addition, it can be expected that there will be expansions, and probably a few major new units, in the intermountain area. Meanwhile, researchers and chemical engineers will continue to improve refining techniques and to increase yields. Some of the largest and most active petroleum research organizations in the United States are located in the area. Most notable are those of Shell Development Co. at Emeryville, California Research Corp. at Richmond and Union Oil Co. of California at Wilmington.

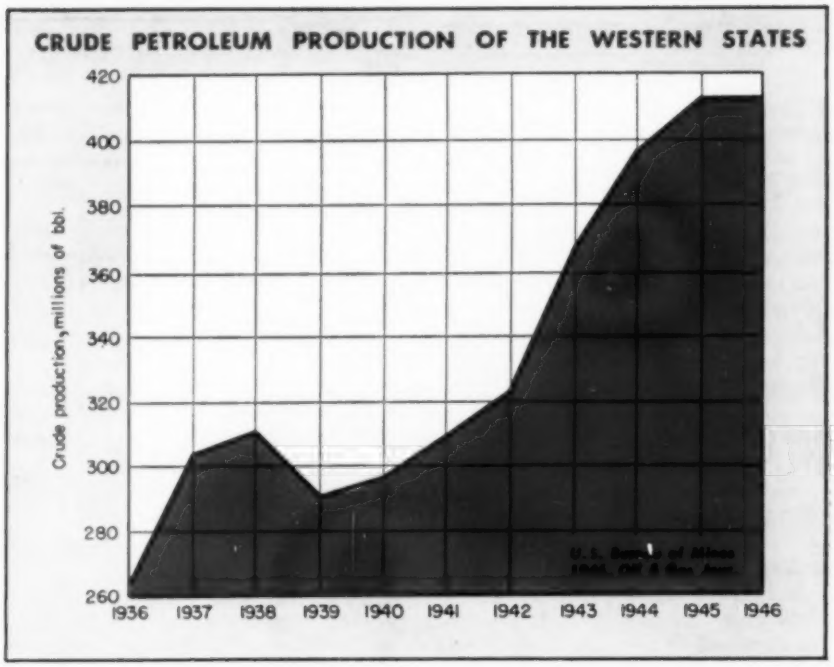
With respect to natural gas, the situation is more serious. The heavy drain on the gas reserves of California has been caused by large demands for industrial, commercial and domestic purposes. A pipeline from Texas, scheduled for completion this fall, will augment the supply to Southern California by some 305 million cubic feet daily or about 18-20 percent of the state's production rate. A second such pipeline is reported to be in the planning stage. New reserves of natural gas have recently been found in Wyoming and elsewhere, but this can probably flow eastward or to the intermountain area more cheaply than to central and southern California. Trend within the next few years will probably be toward tightened restrictions on certain uses of natural gas (forcing some new industries to depend on fuel oil or other sources of energy) and increased importation by pipeline



CALIFORNIA OUTPUT OF NATURAL GAS AND CRUDE PETROLEUM[1]

Year	Natural Gas,[2] 1,000 cu. ft.	Crude Petroleum, Bbl.
1936..	298,922,708	214,776,227
1937..	323,883,714	238,558,562
1938..	332,358,439	249,395,763
1939..	340,754,804	224,253,110
1940..	352,871,945	223,294,805
1941..	378,173,737	229,664,784
1942..	413,180,942	247,491,289
1943..	443,219,847	284,145,702
1944..	467,743,258	311,717,804
1945..	538,273,934	328,262,400
1946..	516,263,710	[3]317,116,874

[1]California Division of Mines, San Francisco. [2]Includes total production, vented and marketed. [3]Preliminary.



from the Southwest. The use of natural gas as a chemical raw material, insignificant in proportion to the total, will hardly be affected.

Resins and Plastic—Too Small? On a Limb? Opinions Vary

"Out on a limb, limited in expansion by lack of basic materials"—"Not yet large enough to support a subsidiary chemicals or raw materials industry." These two expressions seem to typify the extreme attitudes toward the West's resins and plastics industry, largely concentrated in the Northwest, central and southern California. Both viewpoints have some elements of truth, neither is altogether balanced. The industry, largely an outgrowth of the war years, is difficult to analyze. When the raw material supplier tries to evaluate the market, he usually thinks in terms of present actual and future assured uses; the fabricator answers in terms of present *desired* and future *visualized*. It takes a clear head to evaluate the present and predict the future.

In the resins field, the phenolics are obviously the leaders. For plywood alone in the Northwest, the phenol equivalent consumption is 10,000,000 lb. or more and would increase 50-75 percent if the resins were readily available. Probably 10,000,000 lb. of phenol could find a ready market in the California resins and plastics field and another 5,000,000 lb. for miscellaneous uses, such as for petroleum refining and synthetic resin ion exchangers. There is no production of synthetic phenol in the West at present; this affects formaldehyde output and is affected, in turn, by the benzol situation. Paint and varnish producers on the Pacific Coast could probably account for 8-10 percent or more of the national total use of phenolic resins in protective coatings.

The alkyd resins set-up is better integrated now that Oronite Chemical Co. has begun production of phthalic anhydride from ortho-xylol. Original design capacity of this plant was announced at 3,500-4,000 tons annually or about four percent of the United States production for 1946. In 1938, there were two small Western producers of alkyd resins for sale; now there are eight, with major expansions still under way (see table). Largest producer is General Electric Co., with a planned capacity of 4,050,000 gal. of unthinned resins annually.

Present West Coast demand for styrene has been placed at around 1,000,000 lb. monthly, about 95 percent for polystyrene and five percent for the monomer. This demand is about 25 percent of the design capacity of the styrene unit operated in Los Angeles by Dow Chemical Co. for the government synthetic rubber program. The need for polystyrene by the plastics industry will without doubt increase considerably in the near future. At present, there are no facilities in the West supplying polystyrene.

Of close to 500 molders in the United States using phenolic powders, about 20 percent are located on the Pacific Coast. There are some 30 phenolic laminators on the Coast, but no producer of laminating varnishes as of early 1946. There are two producers of industrial phenolic casting resins. Taylor Fibre Co. is the first

OPERATING PETROLEUM REFINERIES IN THE WEST*

	Number of Refineries	Total Daily Crude Capacity, Bbl.	Daily Cracking Capacity, Bbl.	Refineries with Lube Units	Refineries with Catalytic Crackers
California	53	939,050	593,300	6	24
Colorado	7	15,000	7,490	..	6
Idaho	1	2,100	530	..	1
Montana	10	40,400	19,050	..	7
New Mexico	8	13,150	4,850	..	4
Utah	4	23,400	16,100	1	2
Washington	1	6,000	2,500	..	1
Wyoming	21	77,080	37,450	2	9
Total	105	1,116,180	681,270	9	54†

*As reported by Oil & Gas Journal, March 22, 1947. †Includes six refineries with fluid catalytic crackers, three with TCC units, one with Houdry and one with cycloversion.

firm to set up a large plant west of the Mississippi to produce high-pressure laminated plastics and to manufacture standard phenolic sheets, rods and tubes. Of approximately 1,500 fabricators of plastics from sheets, rods and tubes in the nation, some 225 are located on the Pacific Coast—average capacity is unknown.

Some of the resins and plastics materials now produced in the West are ethyl alcohol, glycerine, casein, formaldehyde, styrene (monomer), phthalic anhydride, acetone, inorganic catalysts, wood flour and fillers, cresols and cresylic acids. Materials not produced commercially in the area include vinyl chloride, acetate and other derivatives, ethyl cellulose, adipic acid, cellulose acetate, hexamethylenetetramine, urea, synthetic phenol, synthetic fibers (a rayon plant is projected for the Northwest), acetic anhydride, polystyrene, acrylic acid and methacrylates, pentaerythritol, allyl alcohol and chloride, most organic plasticizers, resorcinol, maleic anhydride, furfural, coumarone. Some of these products are major factors in the West Coast industry, others are insignificant.

In short, the West's resins and plastics industries may be evaluated broadly as follows: in numbers, relatively large; in average size, relatively small; present markets, somewhat limited and in a state of flux; future markets, potentially promising; raw materials, in need of better integration along some lines.

Rubber and Products—West Has Good Basic Position

WITHIN the past decade, the Los Angeles area has developed into one of the larger concentrated rubber centers in the United States. Total value of rubber and rubber products produced in California during 1946 has been placed at some $180 millions or about 8 percent of the national total as compared to 7 percent for 1939. Wage earner employment in these industries has increased 130 percent over that for 1939, but has dropped from the 1944 peak of a 220 percent increase.

Tires and tubes, a major segment of the California industry, has increased employment-wise some 160 percent over 1939. With four major tire manufacturing plants in Los Angeles, this area had a capacity in

PRIMARY PRODUCERS OF BASIC FERTILIZER CHEMICALS IN THE WEST[1]

Firm	Plant Location	Products
American Potash & Chemical Corp.	Trona, Calif.	KCl, K_2SO_4
Anaconda Copper Co.[6]	Anaconda, Mont.	H_3PO_4, double superphos.
Bonneville, Ltd.	Wendover, Utah	Muriate of potash
Colorado Fuel & Iron Corp.[2]	Pueblo, Colo.	$(NH_4)_2SO_4$
Consolidated Mining & Smelting Co.	Trail, B. C.	NH_3, $(NH_4)_2SO_4$, NH_4NO_3, Amm. phosphates
Dow Chemical Co.	Pittsburg, Calif.	Ammonia
Geneva Steel Co.[2]	Provo, Utah	$(NH_4)_2SO_4$
Hercules Powder Co.	Hercules, Calif.	Ammonia
International Minerals & Chemical Corp.	Carlsbad, N. M.	KCl, K_2SO_4, Pot. mag. sulphate
Kaiser Steel Co.[2]	Fontana, Calif.	$(NH_4)_2SO_4$
Lodi Fertilizer Co.[3]	Farmington, Utah	Superphosphate
Maas Chemical Co.	South Gate, Calif.	H_3PO_4
Max Krotki	Marysvale, Utah	Alunite
Permanente Metals Corp.[4]	Permanente, Calif.	Fused phosphate
Potash Co. of America	Carlsbad, N. M.	KCl, K_2SO_4
Shell Chemical Corp.[6]	Shell Point, Calif.	NH_3, $(NH_4)_2SO_4$
Simplot Fertilizer Co.[5]	Pocatello, Idaho	Superphosphate
	Fort Hall, Idaho[5]	H_3PO_4, triple superphos.
Stauffer Chemical Co.[6]	Stege, Vernon, Calif.	Superphosphate
U. S. Potash Co.	Carlsbad, N. M.	Muriate of potash

[1]Some of these products are produced primarily for chemical rather than fertilizer usage. Does not include organics, manure salts, formulators, wet-base goods or producers of synthetic ammonium sulphate. [2]From byproduct coke oven operations. [3]Just announced as now getting under way. [4]Calcium magnesium phosphate from fused serpentine and phosphate rock. [5]Construction expected to begin this year, production by late 1948. [6]Major expansions announced, under way or just completed.

WESTERN PRODUCERS OF ALKYD RESINS FOR RESALE

Producer	Plant Location
American Cyanamid Co.[2]	Azusa, Calif.
Andrew Brown Co.[1]	Los Angeles, Calif.
California Flaxseed Products Co.[1]	Vernon, Calif.
California Ink Co., Inc.[2]	Berkeley, Calif.
General Electric Co.[3]	Anaheim, Calif.
Reichhold Chemicals, Inc.[2]	S. San Francisco, Calif.
	Seattle, Wash.[3]
Sherwin-Williams Co. of Calif.[2]	Emeryville, Calif.
Specialty Resins Co.	Los Angeles, Calif.

[1]Producing in 1938. [2]Expansion under way or announced. [3]New plant beginning operations in 1947.

CALIFORNIA RUBBER AND RUBBER PRODUCTS INDUSTRY

	Wage Earners, Average*	Index,* 1940 = 100	Total Value of Products†	Percent of United States†
1939	4,900	96.1	$61,161,000	6.78
1940	5,100	100.0	65,400,000	6.62
1941	6,200	121.6	85,100,000	6.10
1942	8,800	172.5	133,900,000	8.32
1943	14,300	280.4	263,500,000	10.51
1944	15,700	307.8	294,700,000	10.79
1945	12,700	249.0	241,200,000	9.28
1946	11,300	221.6	179,500,000	7.48

*California Div. of Labor Statistics & Research. †Estimated by the California State Chamber of Commerce, Research Dept. Based on number of wage earners and payrolls.

SALES OF COMMERCIAL FERTILIZERS IN CALIFORNIA, TONS

	1939	1946
Ammonium nitrate	.....	78,595
Ammonium phosphates	12,615	27,702
Ammonium sulphate	66,364	66,133
Blood meal	1,928	551
Bone meal	1,467	1,304
Calcium nitrate	15,459	2,209
Cottonseed meal	1,227	.....
Cyanamid	1,754	7,058
Fish meal	4,032	642
Phosphoric acid, liquid	.....	3,574
Mixed goods	61,519	286,260
Potash salts	2,492	2,045
Sewage sludge (activated)	1,181	2,765
Sodium nitrate	5,349	12,119
Superphosphates[2]	13,841	40,887
Tankage	2,858	214
Urea	598	1,185
Miscellaneous[3]	6,545	15,770
Not segregated by registrant	20,721	22,483
Corrected by audit	1,908	782
Total	220,431	572,458

[1]California Dept. of Agriculture, Bureau of Chemistry. Basis calendar year. [2]For 1946, approximately 35,369 tons single superphosphate and 5,518 tons triple superphosphate. [3]For 1946, includes 2,906 tons ammoniated superphosphate, 6,303 tons fused calcium magnesium phosphate and 3,978 tons nitrogen solutions.

early 1946 of approximately 47,000 tires daily or some 15 percent of national capacity; actual production was much less. Value of tire and inner tube output by California in 1939 was some 9 percent of the United States total. Regardless of the times, several factors will combine to keep the Pacific Coast tire consumption higher than the national norm—increasing population, higher-than-average per capita income, abnormal annual mileage piled up by California car owners.

With other rubber products, the West seems to be happily integrated. There are a number of well-established firms on the Pacific Coast and several large new plants have been recently announced. Thermoid Co. is building a plant in Utah, while Colorado is well represented by Gates Rubber Co., largest firm of its kind west of the Mississippi.

With the war, a synthetic rubber industry was established in Los Angeles with an annual capacity of about 90,000 tons of buna-S or some 12 percent of national total. From basic petroleum raw materials to finished tires and tubes, the Los Angeles synthetic rubber set-up is the best integrated in the United States. However, the industry is operating below capacity, and the unit of U. S. Rubber Co. has ceased production. Final fate is still a matter of conjecture modified by national policy on synthetic rubber, magnitude of regional markets, comparative costs with other producing plants, and competitive cost of natural rubber. The guesses usually hover around a figure of 20-35 percent of the buna industry to be retained. Insofar as finished rubber products are concerned, what is lost by the synthetic industry will most likely be taken up by natural rubber, so that the fabrication industry of the area will change little.

Consumption of chemicals by the synthetic rubber industry is concentrated on styrene (see resins and plastics), salt, sulphuric acid, soap, benzol, carbon black, aluminum chloride, talc, rayon. Consumption of paper cartons is considerable, but most of the accelerators, antioxidants, modifiers and other specialty chemicals originate outside the area.

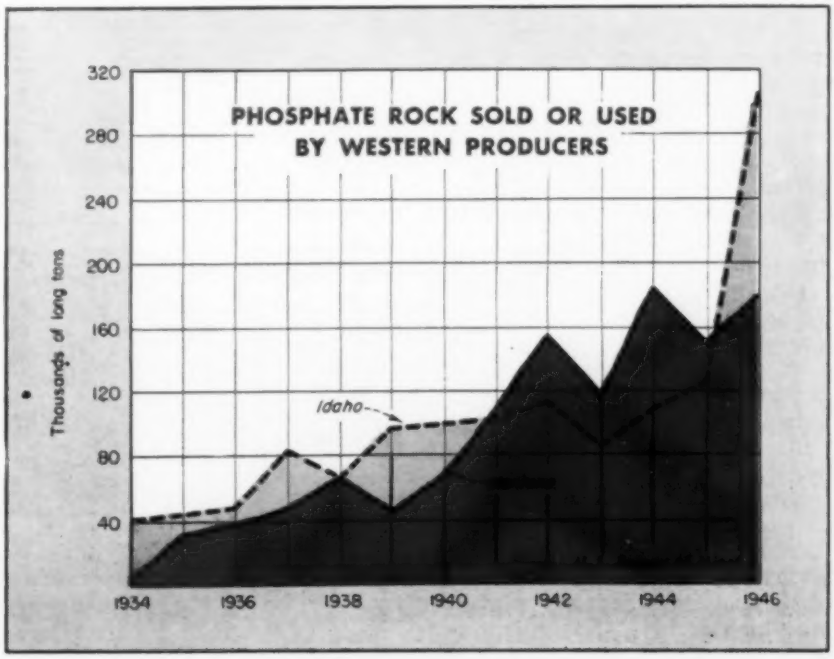
Farm Chemicals—Wanted: More Research, More Production

TWENTIETH century bonanza of the West is agriculture. To a considerable extent characterized by large-scale or intensive operations, a high order of mechanization, relative freedom from weather worries, fertile soils, the West's farming areas have made hay (literally and figuratively) while the sun shines. Problems, growing in importance, include distance from major consuming markets, increasing depletion of virgin soils, insects, fungi, nematodes and other "vermin" that also thrive in the climate, high labor and handling costs. The answers are being found in more processing operations in the growing areas, increasing use of fertilizers and soil supplements, even more mechanization, ready acceptance of the chemical warfare agents against insects and plant diseases. The response from

SALES OF FERTILIZERS IN THE WEST, SHORT TONS*

	1935-1939 Average	1946†
Montana.....	4,154	10,000
Idaho.....	5,186	48,000
Wyoming....	1,522	4,000
Colorado.....	2,694	22,370
New Mexico.	2,112	14,806
Arizona.....	6,279	30,393
Utah.....	1,990	17,825
Nevada.....	500	1,000
Washington...	24,630	90,338
Oregon.....	16,260	74,000
California....	209,123	570,224
Total.....	274,450	882,956

*National Fertilizer Association. Based to tax tag sales. Does not include direct government distribution. †Preliminary.



CHEMICAL CONSUMING INDUSTRIES

chemical industry is being expressed in this formula: more and better fertilizer materials, more effective and specific insecticides, intensified research.

In 1946, Western consumption of fertilizer materials totaled 883,000 tons or an increase of 222 percent over that for the 1935-39 period; in the same time interval, the national increase was 100 percent flat. California was the largest user in the area, accounting for 65 percent of the total for 1946. This was an increase of 173 percent over 1935-39 (see tables and chart). In the past decade, the West has increased its fertilizer consumption from 3.8 to 6.1 percent of the national total.

With nitrogen, probably most needed plant food element on the Pacific Coast, substantial expansions have already been undertaken (see section on synthetic ammonia). Superphosphate capacity of the West, now close to 550,000 tons or more, has increased some 250 percent over that for 1940. All major producers have expanded since 1945. In addition, Permanente Metals Corp. began last year the commercial production of a new type of calcium magnesium phosphate fertilizer made by electric-furnace fusion of serpentine and phosphate rock. Although only 6,300 tons of this 18 percent P_2O_5 material was sold in California last year, the firm's capacity has now been increased to 6,000 tons monthly of Thermo-Phos.

Perhaps most significant move within the last decade in the Western fertilizer field is the recent announcement by Simplot Fertilizer Co. of plans to build a plant in Idaho to produce 50,000 tons annually of 47 percent triple superphosphate from each of four electric furnaces eventually planned (*Chem. Eng.*, July 1947, p. 184). If pilot plant work pans out, construction of the commercial plant is expected to begin this year, production by late 1948. Such an operation, together with present facilities, would probably supply Western and certain mid-Western needs for agricultural phosphorus until approximately 1960 or later.

Agricultural potash, relatively little needed by Western soils (some 15,600 tons K_2O so used in 1945) is produced almost exclusively in the area. Both production and sales reached a new high in 1946. National production, largely from New Mexico, California and Utah, climbed to 931,812 tons equivalent K_2O, an increase of 6.6 percent over that for 1945.

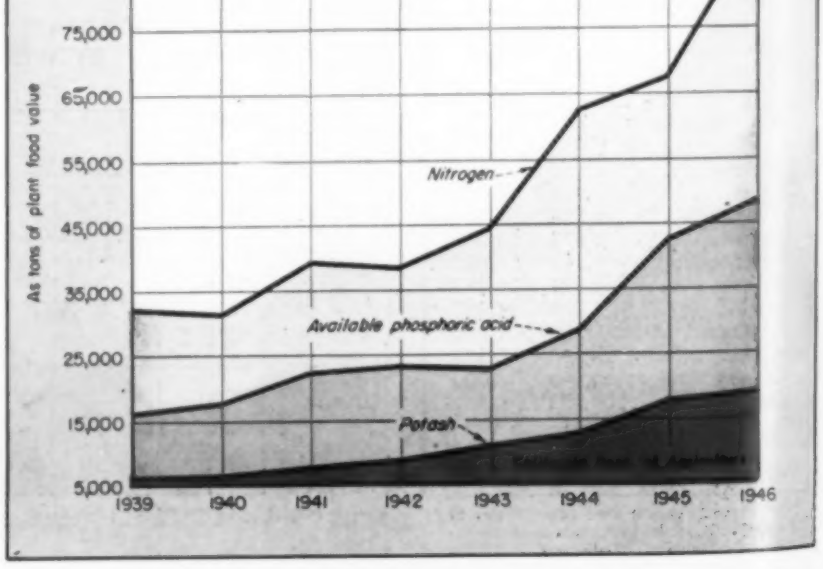
There are few statistics on production or consumption of insecticides and related materials in the West. The consumption of these, albeit, is substantial and growing. Within the past two years, practically every producer in the area has expanded facilities, and a number of new plants have been erected. Now with two basic producers of DDT (see halogenated hydrocarbons), the West's manufacturing capacity for this insecticide is estimated at the neighborhood of 3,000-4,500 tons annually or between 12-20 percent of the present national rate of output. Other agricultural chemicals produced commercially in the area include petroleum oils, arsenicals, 2,4-D, sodium chlorate, chlordane, sulphur, hexaethyl tetraphosphate, ethylene dibromide, methyl bromide, HCN, copper compounds.

Among the larger facilities established in recent years by private industry for agricultural research are those of Shell Oil Co., Inc., Dow Chemical Co., Stauffer Chemical Co., Union Oil Co. of California.

PRIMARY PRODUCERS OF GLASS IN THE WESTERN STATES

Producer	Plant Location	Products
A. H. Forgar & Co.	Los Angeles, Calif.	Pressed and blown
Ball Bros.*	El Monte, Calif.	Containers
Brock Glass Co., Ltd.	Santa Ana, Calif.	Pressed and blown
Crown Glass Works, Inc.	Arcadia, Calif.	Pressed and blown
Denver Glass Bottle Co.*	Denver, Colo.	Containers
Glass Containers, Inc.	Los Angeles, Calif.†	Containers
	Antioch, Calif.*	Containers
Hayward Optical Glass Co.	Whittier, Calif.	Optical
Hazel-Atlas Glass Co.	Pomona, Calif.*	Containers
	Oakland, Calif.	Containers
Kerr & Co., Alexander H.	Santa Ana, Calif.	Containers
Latchford-Marble Glass Co.	Huntington Park, Calif.†	Containers
Maywood Glass Co.	San Jose, Calif.*	Containers
	Los Angeles, Calif.	Containers
Northwestern Glass Co.†	Seattle, Wash.	Containers
Owens-Illinois Pacific Coast Co.	Oakland, Calif.†	Containers
	Los Angeles, Calif.†	Containers
Technical Glass Co.	Los Angeles, Calif.	Pressed and blown

*New plant recently completed or under construction. †Expansion recently completed or under way.



Glass and Ceramics—High Gear Hit to Meet Demand

Output of glass containers in the West is hitting a high stride, reflecting largely the growth of the beverage and food processing industries of the region. Look at the accompanying table of primary glass producers—13 plants manufacturing or preparing to manufacture containers. This represents five large new plants and at least five substantial expansions in the postwar period. Wage-earner employment during 1946 in the glass and glassware industry of California increased some 139 percent over 1939.

True, output has been crimped by the shortage of soda ash and good silica sand. But with a large new capacity of soda ash to begin output in 1948 and with recently-developed deposits of glass-grade silica, especially in the Northwest, the glass industry should have sufficient basic raw materials. A large Fiberglas plant, to be under construction soon by Owens-Corning Fiberglas Corp., is expected to begin operations in California late in 1948.

There is apparently one gap in the glass economy of the West: with the highest regional percentage of residential and industrial construction in the nation, the Pacific Coast still hauls window and plate glass it needs some 2,000 miles or more. This unbalanced condition is being investigated.

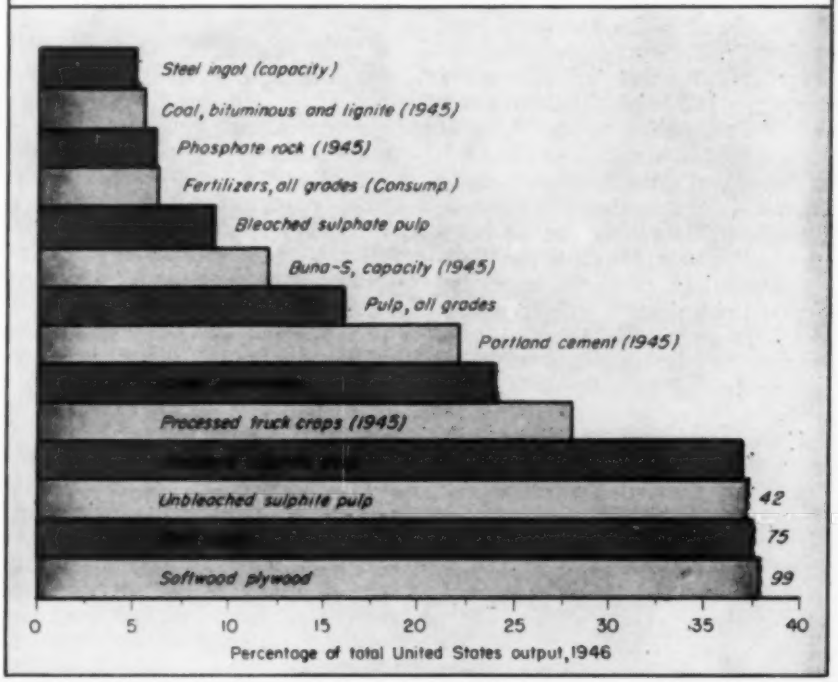
In the ceramics field, Southern California, in particular, is attaining maturity, but has not yet quite reached total raw material integration. Major postwar developments in this industry are the expansions of Gladding, McBean & Co., U. S. Porcelain Enamel Co. and Ferro-Enamel Corp. In the refractory field, Permanente Cement Co. has built a new brick plant in California, with a daily capacity of 100 tons, and General Refractories Co. has purchased the government fire brick plant at Lehi, Utah, that has a capacity of 4,000,000 units yearly.

PRODUCERS OF PHOSPHATE ROCK IN THE WEST[1]

Producer	Mine Location	Disposition
Anaconda Copper Mining Co.	Conda, Idaho	Anaconda, Mont.[2]
Garfield Chemical & Mfg. Co.	Springfield, Utah	Iron blast furnaces
International Minerals & Chemical Corp.[3]	Sherryl, Mont.	Stocks
Lodi Fertilizer Co.[4]	Laketown Canyon, Utah	Superphosphate
Manganese Products, Inc.[5]	Philipsburg, Mont.	Export, experimentation
Moonlight Mining Co.[3]	Princeton, Mont.	Sales
Montana Phosphate Products Co.	Anderson, Gravely, Mont.	Trail, B. C.[2]
San Francisco Chemical Co.	Montpelier, Idaho	Sales
Simplot Fertilizer Co.[6]	Fort Hall, Idaho	Stocks
Soluble Phosphates, Ltd.[7]	Maxville, Mont.	Sales
Teton Phosphate Co.	Bennington, Idaho	Development

[1]As of 1946 and early 1947. [2]For conversion into phosphate fertilizers and chemical phosphates [3]Limited operations. [4]Announced as ready to begin superphosphate production at Farmington, Utah. [5]Experimental production of fused phosphate fertilizer at Seattle, Wash. [6]Stock-piled, purchasing rock for superphosphate operations. [7]Small operations for direct application to soil.

Estimated Participation of the West in Certain Segments of the National Chemical Process Industry Economy. As approximate percentage of total 1946 production unless otherwise noted



Pacific Chemical Exposition Will Help Integrate Industrial Economy of East and West

JOHN R. CALLAHAM
Pacific Coast Editor, Chemical Engineering, San Francisco, Calif.

EXPOSITION AND INDUSTRIAL CONFERENCES TO CRYSTALLIZE PROGRESS, ASSETS AND NEEDS OF THE REGION

The first Pacific Chemical Exposition and Industrial Conferences, to be held in San Francisco during October 21-25, were organized to become a show case and clearing house for technical and market information on the Western chemical, process and equipment industries. Here the executive, engineer and chemist from the East can see what the region has and needs, the Westerner can learn more about what the rest of the nation has to offer. Benefits will be mutual.

KIPLING'S famous remark that the twain shall never meet will no longer hold water insofar as the chemical industry and profession of this country are concerned. East and West will meet, exhibit their products and exchange technical information at the first Pacific Chemical Exposition and Industrial Conferences in San Francisco, October 21-25, at the Civic Auditorium. The affair will be the West's most comprehensive effort to bring together persons from throughout the nation who are interested in the various facets of the Western chemical, chemical equipment and process industries. Special programs have been arranged to appeal to management, engineering and technical personnel, and to chemical economists.

For many years, far-sighted leaders in the Western chemical industry have recognized the need for an adequate medium to bring together a vertical representation from the industry in the region as well as from other sections. Too many Westerners have been unable to attend the chemical expositions and meetings in New York and Chicago; Easterners have never had a one-bundle opportunity to see what the West has to sell or to learn what it would like to buy. Technical society meetings have served well as mixers, of course, but usually these are lacking in comprehensiveness and breadth of interest.

Even in the West itself, there have been far too few occasions for men from Puget Sound or the lower Columbia to fraternize with their chemical cousins from Los Angeles, or those from Colorado and the Wasatch Front to sit down with their friends from San Francisco Bay. A rendezvous for the chemical West has long been needed. The violent changes wrought by the war years have accentuated the need for better acquaintance and more inter-regional integration.

Gathered No Moss

By 1945, the concept of a chemical exposition had begun to crystallize in the minds of some of the leaders in the active (northern) California section of the American Chemical Society, sixth largest ACS chapter in the nation, of which Robert Matteson of California Research Corp. is now chairman. By early 1946, the idea had gathered no moss. The prospects had been surveyed and found promising. The section decided to sponsor a Pacific Chemical Exposition to be held biennially, beginning in 1947. A manager was then selected, an exhibit hall obtained, a committee organized. The manager was Marcus W. Hinson, who has handled the National Chemical Exposition in Chicago since its inception in 1940. Paul H. Williams of Shell Development Co. was chosen as chairman of the Exposition Committee. For a complete list of sponsors and committee members, see The Guide and Directory section of this issue, page 309.

In order to broaden the scope of the Exposition and to make its appeal to industrial chemists, engineers and executives more cosmopolitan, a number of technical organizations were invited to participate in the programs of the Pacific Industrial Conferences sponsored by the Exposition. Dr. T. D. Stewart of the University of California was chosen to coordinate this phase of activity. Results have been excellent.

A series of 30 exceptionally good

Societies Participating in the Pacific Industrial Conferences

American Chemical Society, California Section
- Petroleum Group
- Analytical Division

American Institute of Chemical Engineers
- Northern California Section

American Institute of Mining & Metallurgical Engineers
- Industrial Minerals Division, California Section

Golden Gate Paint & Varnish Club

Institute of Food Technologists
- Northern and Southern California Sections

Northern California and Los Angeles Rubber Groups

Pacific Insecticide Institute

Western Chemical Market Research Group

industrial movies will be featured as a continuous program during the Exposition. Selected by a committee headed by Dr. Richard Wistar of Mills College, topics range from glass manufacture to frequency modulation, redwoods to weed control, from atoms to oil refining.

The Cooperating Ten

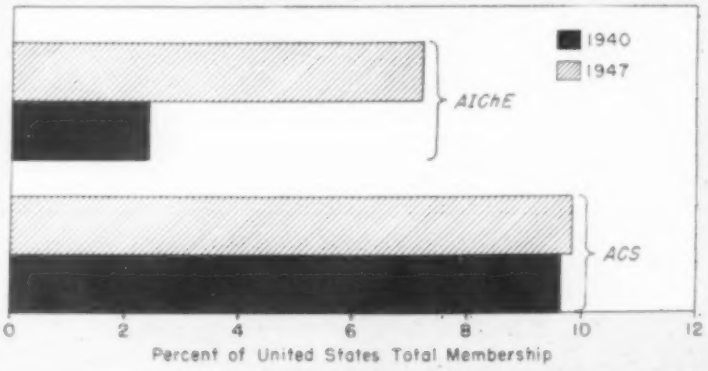
Included in the cooperating organizations that will have programs, mostly full-day affairs, are the petroleum group and analytical division of the California section of the American Chemical Society. Included in the program of the former (see table) are such well-known authorities as Gustav Egloff of Universal Oil Products Co., E. V. Murphree of Standard Oil Development Co. and George L. Parkhurst of Oronite Chemical Co. The analytical division will include speakers from California Research Corp., the Western Regional Research Laboratory, Applied Research Laboratories, Shell Development Co., Consolidated Engineering Co., Applied Physics Corp., and National Technical Laboratories.

The all-day and evening program of the Northern California section of the American Institute of Chemical Engineers, organized by C. R. Nelson of Shell Development Co., will be of wide interest to chemical engineers. Speakers from all over the country will discuss such topics as filtration, mixer technology, stuffing-boxless pumps, new developments in centrifuges, processing kettles, controlled-volume chemical pumps, heat exchangers for acid service, remote control devices. The evening address on "Frontiers in Chemical Engineering" will be given by S. D. Kirkpatrick, editor of *Chemical Engineering*. For the complete program of the AIChE, see the accompanying table.

Speakers at the all-day session of the American Institute of Mining & Metallurgical Engineers will discuss certain non-metallic minerals of interest to the chemical and chemical process industries (partial program shown in table). Among these are perlite and pumice, materials of unusual interest at present, steatite-grade talc, glass sand, California limestone, refractory clays of California, salt, non-metallic minerals used in the insecticide industry, diatomaceous earth, Pacific Northwest raw materials.

The Golden Gate Paint and Varnish Club will stage an evening program devoted to a discussion of silicone resins. The California sections of the Institute of Food Technologists, a particularly active and chemical-conscious group in the state, will have a two-morning session to thresh out some points as chemical aspects of flavors (A. J. Haagen-Smit of California Institute of Technology), products and byproducts of the fishing industry (Sven Lassen of Van Camp Sea Food Co.), recent developments at the Western Regional Research Laboratory of the U. S. Dept. of Agriculture (M. J. Copley, director of the Laboratory). Other subjects include the microbiology of foods, advances in nutrition, proteins and amino acids in the food industry, enzyme problems in the citrus industry.

Growth of western membership in the American Chemical Society and American Institute of Chemical Engineers. Data as of the first of each year.



The Los Angeles and Northern California Rubber Groups will have a full program (see table) on synthetic rubbers, rubber compounding, carbon black and other compounding agents, foam rubber and other specialties, pigment reinforcement and solubility of hydrocarbon resins.

Market Researchers, Attention

Of particular interest to the insecticide industry is the afternoon symposium by the Pacific Insecticide Institute on the practical aspects of chemical plant growth regulators in agriculture. Speakers are from the University of California, a pioneer in the use and evaluation of these agents in California.

For the first known time, an organized effort will publicly be made to evaluate the various segments of Western industry as consumers of chemicals. The active and independent Western Chemical Market Research Group, having just passed its first birthday, has taken up the challenge. In a day-and-evening session, eight addresses (see table) will be devoted to the West's major chemical-consuming industries. An opening paper will deal with the present position of the Western chemical industry, that still-too-unknown entity west of the Rockies. Following this, there will be talks by authoritative industrialists on the West's paint and varnish, plastics, wood, pulp and paper, petroleum, food processing and agricultural industries—all as *consumers* of chemicals. An evening address will be given by Dr. T. J. Kreps on the subject "Chemicals Upset Economics."

All persons registering at the Exhibition are invited to attend any and all programs presented by the participating groups at the Pacific Industrial Conferences. A complete program can be obtained from Marcus W. Hinson, manager, Pacific Chemical Exposition, Hotel Whitcomb, San Francisco.

Show Case for Equipment

At the Exposition itself, some 125 manufacturers and representatives from throughout the nation will exhibit, demonstrate and explain their wares, standard items as well as new developments. Technical attendants will be on hand at the 110 booths to answer questions, explain and exchange know-how. Here the Western manufacturer in the chemical and process industries can handle and evaluate first-hand the raw materials, equipment and instruments which he might be able to use in his plant, process or product.

Here, for the first time, the equipment, instrument, raw material, package and chemical products supplier from the East as well as from the West will have the opportunity to prove on Western home grounds the merits of his goods. This chance to exchange data and details should prove invaluable to everyone.

In the equipment field, exhibits will include items ranging from absorbers to water treatment, air conditioning, bottlers, calciners and condensers, digesters and dryers, ejectors and ex-

hausters, from fans to valves, regulators to thermometers, glassware to tanks. Included will be pumps, condensers, filters, fittings, industrial and scientific instruments, magnetic separators, manometers, proportioning equipment, regulators, screens and stills. For a complete directory of exhibitors and process equipment, see pages 309-339.

Chemical raw materials and products range from acids to xanthates, alkalies and aromatics, perlite and dyestuffs, DDT and detergents, ion exchangers and esters. Included will be plasticizers, drying agents, polybutenes, silicates, synthetic resins, solvents, amino acids. For a complete directory of exhibitors and chemical products see pages 309-339 of this issue.

What Do We Think?

The biennial Pacific Chemical Exposition can, and should, develop into a valuable market place and common meeting ground for the technologists, economists and executives of the chemical, chemical process and equipment industries of the West as well as those of the East interested in Western markets. It is for those persons and for these reasons that *Chemical Engineering* recommends, with confidence and without reservations, the 1947 Pacific Chemical Exposition and Industrial Conferences in San Francisco.

TECHNICAL AND SURVEY PROGRAM OF THE PACIFIC INDUSTRIAL CONFERENCES SPONSORED BY THE PACIFIC CHEMICAL EXPOSITION

OCTOBER 21

Pacific Insecticide Institute (afternoon)

Chemical Plant Growth Regulators as Herbicides — W. W. Robbins, University of California, Berkeley
Chemical Plant Growth Regulators on Tree Crops — W. S. Stewart, University of California, Riverside
Chemical Plant Growth Regulators on Field Crops — L. K. Mann, University of California, Davis

Western Chemical Market Research Group (day and evening)

Present Position of Western Chemical Industry — W. J. O'Connell, Jr., W. J. O'Connell & Associates, San Francisco; J. R. Callaham, CHEMICAL ENGINEERING, San Francisco
Western Paint & Varnish Industry as a Consumer of Chemicals — R. W. Reese, H. L. Wampner, Reichhold Chemicals, Inc., S. San Francisco
Western Plastics Industry as a Consumer of Chemicals — A. J. Norton, Consultant, Seattle
Western Wood Industry as a Consumer of Chemicals — C. C. Heritage, Weyerhaeuser Timber Co., Longview, Wash.
Western Pulp & Paper Industry as a Consumer of Chemicals — R. G. Mispley, Crown Zellerbach Corp., Camas, Wash.
Western Petroleum Industry as a Consumer of Chemicals — E. W. Weaver, Union Oil Co. of Calif., Los Angeles
Western Food Processing Industry as a Consumer of Chemicals — T. L. Swenson, Stanford Research Institute, Palo Alto
Western Agriculture as a Consumer of Chemicals — R. J. Hansberry, Shell Oil Co., Inc., Modesto, Calif.
Chemicals Upset Economies — T. J. Kreps, Stanford University, Palo Alto

OCTOBER 22

American Institute of Chemical Engineers (day and evening)

Filtration in Western Process Industries — W. W. King, Oliver United Filter Co., San Francisco
Visual Analysis of Action on Bubble Trays — A. L. Whistler, C. F. Braun Co., Alhambra, Calif.
Mixer Technology — E. J. Lyons, Turbo Mixer Corp., New York
Probolog: Inspection Tool for Tubular Heat Exchange Elements — M. V. Long, Shell Development Co., San Francisco
Stuffing Box-less Pumps — A. Hollander, Byron Jackson Co., Los Angeles
New Developments in Centrifuges for Western Chemical Industries — C. M. Ambler, Sharples Corp., Philadelphia
Design and Operation of Controlled Volume Chemical Pumps — R. T. Sheen, Milton Roy Co., Philadelphia
New Developments in Processing Kettles — A. W. Johnson, Blaw-Knox Co., Buffalo, N. Y.
Developments in Fluid Circulation Heat Exchangers for Acid Service — D. R. Stiehl, Duriron Co., San Francisco
Application of Remote Control Devices to Diaphragm Valves — R. T. Kidde, Hills-McCanna Co., Chicago
Chemical Engineering Frontiers — S. D. Kirkpatrick, CHEMICAL ENGINEERING, New York

American Chemical Society, Petroleum Group (afternoon)

Applications of Fluidized Solids Technique — E. V. Murphree, Standard Oil Development Co., New York
Manufacture of Gasoline by Polymerizing Propene and Butene — L. F. Brooke, California Research Corp., Richmond, Calif.
Automatic Laboratory Batch Distillation Column with Automatic Reflux Ratio Advance — L. S. Galstaun, Tide Water Associated Oil Co., Associated, Calif.

OCTOBER 23

American Chemical Society, Petroleum Group (afternoon)

Investigation of Deposition and Oil Deterioration by a Motored Engine — H. Diamond, Shell Development Co., Emeryville, Calif.
Selenium-Containing Lubricant Additives — F. C. Croxton, Battelle Memorial Institute, Columbus, Ohio
Discussion of Safety Fuel — A. G. Cattaneo, Shell Development Co., Emeryville, Calif.
Aromatic Hydrocarbons from Petroleum — G. L. Parkhurst, Oronite Chemical Co., San Francisco
Use of Dihydrophthalic Acid in Alkyd Resins — F. C. Lum, L. H. Brown, Oronite Chemical Co., San Francisco

American Institute of Mining & Metallurgical Engineers, Industrial Minerals Div. (all day)

Perlite and Pumice in California — C. R. King, California Division of Mines, San Francisco
Non-Metallic Minerals Used in Insecticide Industry — L. R. Moretti, Industrial Minerals & Chemical Co., San Francisco
Diatomaceous Earth — T. A. Copeland, Eagle Picher Co., San Francisco
Salt Industry — D. S. See, Leslie Salt Co., San Francisco
Developments in Minerals and Raw Materials of Pacific Northwest — R. J. Anderson, Raw Materials Survey, Inc., Portland

Golden Gate Paint and Varnish Club (evening)

Silicone Resins — J. R. Patterson, General Electric Co., Schenectady, N. Y.
Basic Silicate of White — E. P. Peterson, National Lead Co., New York

Rubber Groups, Northern California and Los Angeles (afternoon)

Motion Pictures and Commentary on Rubber Compounding — Leonard Boller, Technical Coatings, Inc., Pasadena
GRS — D. C. Maddy, Standard Chemical Co., Los Angeles
Neoprene — Herman Jordan, E. I. duPont de Nemours & Co., San Francisco
Hycar — Ray Bitter, B. F. Goodrich Chemical Co., Los Angeles
Thiokol — W. B. Boswell, Thiokol Corp., Los Angeles
Perbunan and Butyl — E. N. Cunningham, R. M. Howlett, Enjay Co., Los Angeles
Panel Discussion on Compounding — Eight leaders from the San Francisco area

OCTOBER 24

Rubber Groups, Northern California and Los Angeles (afternoon)

Carbon Black and Other Compounding Agents — W. R. Snyder, R. T. Vanderbilt Co., Los Angeles
Foam Rubber, Hard Rubber and other Specialties — R. T. Hickcox, Goodyear Rubber & Tire Co., Los Angeles
Mechanism of Pigment Reinforcement of Rubber — L. H. Cohen, Witco Chemical Co., New York
Solubility of Hydrocarbon Resins and Behavior in Rubber Compounds — P. O. Powers, Battelle Memorial Institute, Columbus, Ohio

This is not a complete program, but has been selected on the basis of probable interest to engineers and executives in industry.

Performance and Design of Agitators

D. E. MACK and V. W. UHL

Respectively, Associate Professor of Chemical Engineering, Lehigh University, Bethlehem, Pa., and Design Engineer, Bethlehem Foundry and Machine Co., Bethlehem, Pa.

EFFECTIVE METHODS FOR PREDICTING PERFORMANCE CHARACTERISTICS PROVIDE A BASIS FOR THE DESIGN OF AGITATOR SYSTEMS

Although there are in the literature many articles which discuss the qualitative aspects of agitation and several good articles which report quantitative findings covering specific processes and special effects, generally speaking, these data have not been presented in a form most convenient for use in solving problems connected with agitator systems. It is the purpose of this work to put forward in a simple usable form, generalized correlations and design data obtained from the literature and experience, and to show how they may be used to obtain the superficial design of a workable and reasonably-efficient tank and agitator system. It will not be concerned with mechanical problems of mixer construction such as gear reducers, stuffing boxes and critical shaft speeds which the manufacturers of agitation equipment are well equipped to handle. Rather, it will concern itself with consideration of impeller type, diameter, speed and theoretical power requirements.

Three commonly-met-with operations involve the use of an agitator: (1) Contacting a gas with a liquid, (2) increasing heat transfer from kettle walls or coils and (3) increasing the mass transfer rate between solids and liquids or two immiscible liquids. There may also be various combinations of all three.

Problems with which an engineer may be confronted concerning these operations are: (1) Design of equipment with no pilot plant data, (2) "scale-up" design based on pilot plant data, (3) redesign of existing equipment for better performance or to compensate for changed conditions.

There have been a number of overall correlations used for anticipating agitator performance employing the variables encountered in the various processes. These correlations use as bases periferal impeller velocity, shaft speed, power per unit liquid volume, or a modified Reynolds number together with the properties of the fluid, to study heat or mass transfer coefficients or reaction rates. Some of these generalized correlations will be presented in a simplified form.

Power absorbed by an agitator is not in itself a measure of agitation intensity. However it does enter into many performance correlations and must always be considered an essential part of any mixer design. Thus, the influence of certain factors on agitator power absorption should be considered before discussing various phases of agitator performance.

Four aspects of agitation are analyzed in the development of practical methods for predicting agitator performance and for designing agitator systems. This article deals with agitator power requirements and gas liquid contacting equipment. A second article will follow with a discussion of mass transfer and heat transfer in agitator systems. The authors show, by examples, how to design such systems either with or without pilot plant data and how to predict performance of existing equipment under changed conditions.

Agitator Power Absorption

Agitator power may be absorbed by a liquid in two ways corresponding to two conditions of agitation which have been labelled "streamlined" and "turbulent." This classification is misleading because the two modes of flow often overlap in actual operation; for instance, there may be considerable turbulence even when the so-called "streamlined" condition dominates. These two modes may be defined by stating how the power is absorbed in each case.

One of the best ways of showing the relationship between the power absorbed and other factors is a plot of the "power function," $Pg/N^3L^5\rho$, versus a modified Reynolds number, $NL^2\rho/\mu$, where:

P = power absorbed by the impeller in ft. lb. per sec.; g = gravity constant in ft. per (sec.)^2; N = shaft speed in rev. per sec.; L = impeller diameter in ft.; ρ = density of liquid in lb. per cu.ft.; μ = viscosity of liquid in lb. per ft. sec.

The modified Reynolds number incorporates the essential components. L corresponds to the shape factor. NL, the periferal speed of the impeller, is assumed proportional to the velocity of the fluid, and ρ and μ have their usual significance. Starting with a modified Reynolds number of low magnitude, the relation between it and the power function has been found to be[7]:

Nomenclature

A = area for heat transfer, sq. ft.
C = Specific heat of the fluid, B.t.u. per deg. F.
D = tank diameter, ft.
d = diffusivity, English Units (hr.)
g = gravity constant, ft. per (sec.)^2
H = liquid depth, ft.
h = heat transfer film coefficient, B.t.u. per hr. per sq. ft. per deg. F.
$hp.$ = power absorbed by stirrer, horsepower
K = mass transfer coefficient, lb. per hr. per sq. ft. per unit conc. dif.
K_a = absorption coefficient, lb. mol. per hr. per cu. ft. per atm.
k = Conductivity of liquid, B.t.u. per hr. per deg. F. per ft.
L = impeller diameter, ft.
N = shaft speed, rev. per sec.
P = power absorbed by impellers ft. lb. per sec.
p = partial pressure, atm.
Q = heat output to liquid, B.t.u. per lb.
q = heat transferred, B.t.u. per hr.
S = number of impellers
T = temperature, deg. F.
V = liquid volume, cu. ft.
W = impeller width (parallel to shaft), ft.
w = weight of material absorbed, lb. mol. per hr.
a, b, c = constants
μ (mu) = viscosity, lb. per ft. sec.
ρ (rho) = density, lb. per cu. ft.
subscript c = at coil surface
subscript j = at jacket surface

$$Pg/(N^3L^5\rho) = c\,(NL^2\rho/\mu)^{-1} \quad \ldots\ldots(1)$$

or

$$Pg = c\,N^2L^3\mu \quad \ldots\ldots(2)$$

Value of c must, in general, be determined for each type of impeller, but holds so long as constant geometric ratios of impeller dimensions are maintained.

The physical significance of Eq. (2) is that the power is absorbed in overcoming friction between the moving impeller and the liquid. The resisting force per unit area of impeller is, as would be expected from the Hagen-Poiseuille equation, (L^2 is proportional to impeller area): Force/$L^2 = c\,(NL)\,\mu/gL$ or (Force) $(g) = c\,NL^2\mu$
Since the force is moved through a length proportional to L in a time proportional to $1/N$, then:

$$(\text{Force})\,(NL)\,(g) = Pg = c\,N^2L^3\mu \quad \ldots\ldots(2)$$

This equation appears to be valid so long as the liquid is not "pumped" by the impeller. All the power is consumed in overcoming friction. The criterion of this state seems to be whether or not the liquid is thrown out radially (or axially in the case of a propeller). If no radial flow takes place, Eq. (2) holds. If the above analysis is correct, then the tank geometry should have no effect on c of the same equation. That this is true is shown experimentally by the fact that the same values for power absorbed are obtained for the "stream-lined" flow region whether the tank is baffled or not[7].

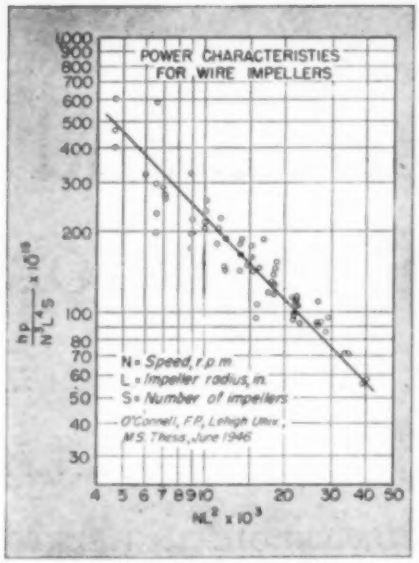

POWER CHARACTERISTICS
FOR WIRE IMPELLERS
N = Speed, r.p.m.
L = Impeller radius, in.
S = Number of impellers
O'Connell, F.P., Lehigh Univ., M.S. Thesis, June 1946
NL² x 10³

Fig. 1—Power requirements of wire impellers are expressed by Eq. (2)

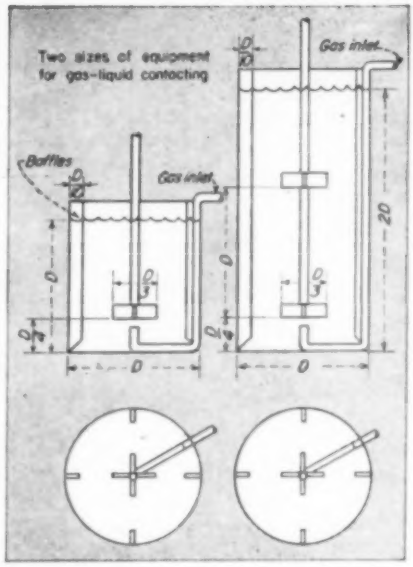


Fig. 2—Turbine type impellers are used for gas-liquid contacting

Conditions which determine when the impeller will begin to throw the liquid out centrifugally, and thereby change its power absorption characteristics, are determined by the geometric configurations of the impeller and the properties of the liquid. High speed alone does not necessarily create centrifugal effect, according to O'Connell,[5] who used impellers made from piano wire that operated in water in the range of 4,000 to 7,000 r.p.m. (see Fig. 1). The liquid was actively agitated as evidenced by turmoil on the liquid surface and dispersion of gas particles in the liquid, and the tank contained baffles, yet because the wire stirrers were too thin to impart any radial motion to the fluid, they continued to follow Eq. (2) for their power demand. (It will be noted that instead of $Pg/N^2L^5\rho$, the power function has been written as Pg/N^2L^4S where L is the length of the wire and S is the number of wires. (LS) is proportional to the area of the stirrers just as L^2 was in the previous discussion.) Distribution of the points in Fig. 1 is random, due to insensitive power measuring instruments.

Impeller Effects

For the usual impeller, however, as the modified Reynolds number increases, radial flow will begin to take place. Swirl will begin to develop unless it is stopped by some outside influence such as baffles. In smooth round tanks without baffles, a circulatory motion will be imparted to the liquid to decrease the relative velocity between impeller and liquid and give the effect of a slower speed impeller. Some liquid will be thrown out by the impeller, but the rotating liquid tends to minimize this effect.

If at this point baffles are introduced, the power will be found to be greatly increased. With swirl stopped, the relative velocity between impeller and liquid will be a maximum and the impeller will act as a liquid pump. When this condition is reached, the power is absorbed according to:

$$Pg = c\,N^3L^5\rho \quad \ldots\ldots(3)$$

or more formally:

$$Pg/N^3L^5\rho = c\,(NL^2\rho/\mu)^0 \quad \ldots\ldots(4)$$

In one revolution the impeller is throwing out a weight of liquid proportional to ρL^3, or ρNL^3 amount per unit time. Liquid is thrown out at a velocity proportional to NL. Power is used to produce liquid velocity or:

$$Pg = c\,\rho NL^3\,(NL)^2 = c\,N^3L^5\rho \quad \ldots\ldots(3)$$

When Eq. (3) holds, that is, when the impeller is acting as a pump and there is no swirl (good baffling) the tank dimensions do not affect the value of c^4. The values of c for Eqs. (2) and (3) are, of course, different. They depend only on impeller dimensions and remain constant for any geometrically-similar set of impellers. In the region where Eq. (2) does not hold, and where no baffles (or inadequate baffling) are present to stop the swirl, the degree of pumping action is an inverse function of the amount of swirl. Since the amount of swirl is determined by the resistance to flow, the tank dimensions, surface roughness, and baffling become determining factors. In this region of flow the power demand is usually equal to[8]:

$$Pg = c\,N^{1.85}L^{4.7}\rho^{1.85}\mu^{0.15} \quad \ldots\ldots(5)$$

Power absorbed by baffled tanks generally runs at least 50 percent greater but may run five times greater than

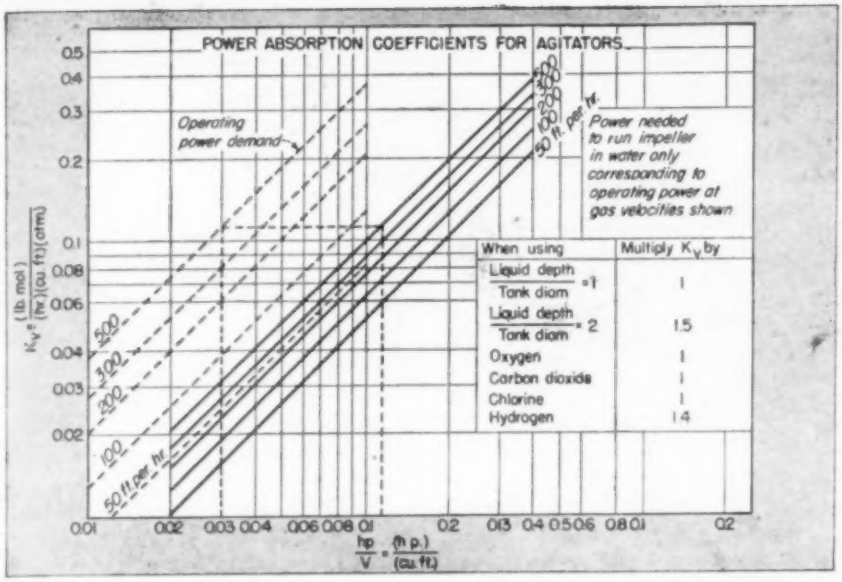


Fig. 3—Power absorption coefficients for agitators, K_v, are developed from data given by Cooper[1] and Foust[2]

power drawn in unbaffled tanks for given shaft speeds. Value of c in Eq. (5) depends on both tank and impeller dimensions. It will remain constant, however, for various sizes of tank and impeller units, if geometrically similar ratios are maintained.

How to Use Data

In the examples that follow, the criteria of "scale-up" of design have been selected arbitrarily without regard to process, in order to illustrate the methods of handling the various power equations.

Example 1—A high viscosity starch paste is being blended in a one cu.ft. pilot plant mixer by a ¼ hp. stirrer operating at 150 r.p.m. A plant-size unit is to be built for 200 times the weight of paste. Geometric similarity is to be maintained. Comparable results are to be expected if the same periferal velocity is maintained in each case. What are the speed and power requirements for the plant-size mixer? Assume viscous flow (for the high viscosity paste). Therefore: $Pg = c\,N^2L^3\mu$ (Eq. 2).

The new volume will be 200 compared with the old volume of unity. Therefore, all dimensions of the new system will be $200^{\frac{1}{3}} = 5.85$ times those of the old system or the new impeller diam. $(L_2) = 5.85\ (L_1)$. Since the same periferal velocity is to be maintained, the new speed will be:

$$N_2 = \frac{150\,\pi\,L_1}{\pi\,L_2} = \frac{150\,\pi\,L_1}{5.85\,\pi\,L_1} = 25.6 \text{ r.p.m.}$$

The new power requirement will be:

$$P_2 = \frac{N_2^2 L_2^3 \mu P_1}{N_1^2 L_1^3 \mu} = \frac{(25.6)^2\,(5.85)^3}{(150)^2\,(4)} = 1.46.$$

Example 2—A paddle stirrer, running in a water solution in a baffled tank, overloads a ½ hp. motor when running at 170 r.p.m. It is decided to use a smaller paddle, running at the same speed, to decrease the impeller load by 25 percent. What percentage reduction in size of the paddle is required? Assume completely turbulent flow. Therefore, use Eq. (3) $Pg = c\,N^3L^5\rho$. $P_2/P_1 = 0.75/1.00 = (N_2^3L_2^5)/(N_1^3\,L_1^5) = (170^3\,L_2^5)/(170^3\,L_1^5)$; $(L_2/L_1)^5 = 0.75$; $L_2 = 0.95L_1$.

Therefore, the paddle should be cut down by five percent on all dimensions.

Example 3—A mixer operating in an unbaffled tank in a pilot plant draws ⅛ hp. at 200 r.p.m. It is believed that comparable results will be obtained in a plant-size unit (50 times greater volume) if the power per unit volume is held constant. Determine the speed and power required for a geometrically-similar plant unit.

Assume that $Pg = c\,N^{2.85}L^{4.7}\rho^{0.85}\mu^{0.15}$ (Eq. 5); $L_2/L_1 = (50)^{\frac{1}{3}} = 3.68$; $L_2 = 3.68\ L_1$; $P_1/P_2 = 1/50$; $P_2 = 50/8 = 6.25$ hp.; $P_1/P_2 = (N_1/N_2)^{2.85}(L_1/L_2)^{4.7} = 0.125/6.25 = (200/N_2)^{2.85}(1/3.68)^{4.7}$; Therefore $N_2 = 91$ r.p.m.

Gas-Liquid Contacting

Turbines have been found to be superior to propellers for gas liquid contacting[2]. The intense agitation necessary for adequate dispersing of the gas requires the use of baffles to eliminate vortexing and to increase the turbulence. To minimize the possibility of gas escaping without dispersing, the diameter of the impeller should be at least one-third of the tank diameter, placed concentric with it and be submerged at least two-thirds of the liquid depth. The baffles (3 or 4 in number) should be equally spaced around the tank and extend close to the bottom. The gas inlet should be placed immediately below and centered with respect to the impeller. The liquid height should be about equal to the tank diameter for a single impeller. The height may be doubled if two impellers are used. More than two impellers requires excessive shaft extension with resulting mechanical difficulties unless a step bearing is used. (See Fig. 2 for dimension ratios).

Size of tank will be determined either by the amount of liquid or by the amount of gas to be treated. If the latter is the deciding factor, the superficial gas velocity (cu.ft. per hr. of gas per sq.ft. cross sectional area of tank) should not exceed 300 ft. per hr. for one impeller or 500 ft. per hr. for two impellers. Gas velocities appreciably higher than these will allow too much gas to escape dispersion. Flat, slightly conical or dished bottom tanks exhibit negligible performance differences.

Amount or rate of absorption can be calculated by using an absorption coefficient K_v (lb. mol. per hr. per cu.ft. of liquid per atm. driving force). This coefficient can be approximated by the use of the chart given in Fig. 3. Values of K_v for gases other than oxygen have been estimated, using an analogy between known tank and tower oxygen absorption coefficients as the basis[3,6,9]. The values so obtained are all for absorption in aqueous solutions. However, since it is assumed that the liquid film is the controlling factor in bubble-type absorption for the gases listed and since liquid diffusion rates for gases in liquids are all similar[8], the values should hold approximately for non-aqueous systems also.

Data of Cooper[1] and Foust[2] were used in developing the plot shown in Fig. 3. During gassing, the power drawn by the impeller is considerably less than that drawn at the same speed without the gas flowing. Equipment should, therefore, be designed on the basis of the power which the impeller would draw without gassing, so that the motor will not overload if the gas flow should be interrupted, and so that the stirrer can be specified in manufacturer's terms of "horsepower drawn while running in water." Thus, an agitator might be specified as: "a 12 in. diameter impeller which will draw 1.5 hp. in water." The manufacturer can then select from his stock models, one which best matches the specifications.

It can be shown[7] that for very turbulent conditions such as would be found in a gas-liquid contactor, the viscosity

(*Continued on page 125*)

G.E.'s large plastics plant at No. 1 Plastics Ave., Pittsfield, Mass., showing phenol plant at upper left

PHENOL From Monochlorbenzol

JAMES A. LEE
Managing Editor, Chemical Engineering

G.E. HAS DEVELOPED AND PUT IN OPERATION CONTINOUS PROCESS FOR MAKING PHENOL FROM MONOCHLORBENZOL

It was early recognized by the engineers of the General Electric Co. that the mechanical and electrical characteristics of phenolic resins make them particularly well suited for electrical equipment. Therefore, it is only natural that G. E. became one of the first users of these resins. This early appraisal of the value of this and other synthetic resins proved to be well founded and the company's interest in the field of plastics has kept pace with the rapid expansion in the industry.

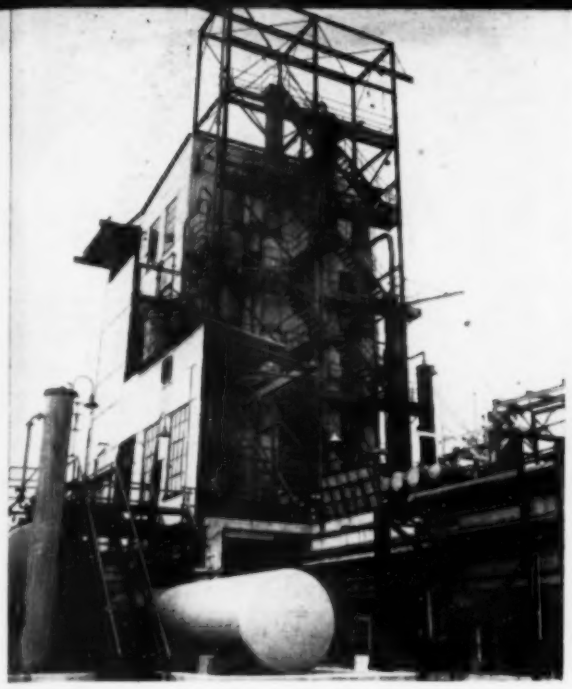
Many years ago the management decided to add to its large plastic molding business a section for the production of phenolic resins and molding powders. Another forward step was taken during the recent World War when it became difficult to obtain phenol. This time the company entered upon a program calling for the production of a principal raw material. Completion of this plant makes G. E. unique in that it is the only company in the United States to start with the production of the chemicals, convert them into resin, then the molding powder, or varnish, and finally fabricate them into a long list of finished molded or laminated products.

This article will be concerned primarily with a description of the plant and process for the production of phenol. G. E.'s chemists and engineers installed a process for making this chemical from benzol, chlorinating the benzol to monochlorbenzol and hydrolyzing this intermediate to phenol. The plant is at Pittsfield, Mass., headquarters for the company's Chemical Department.

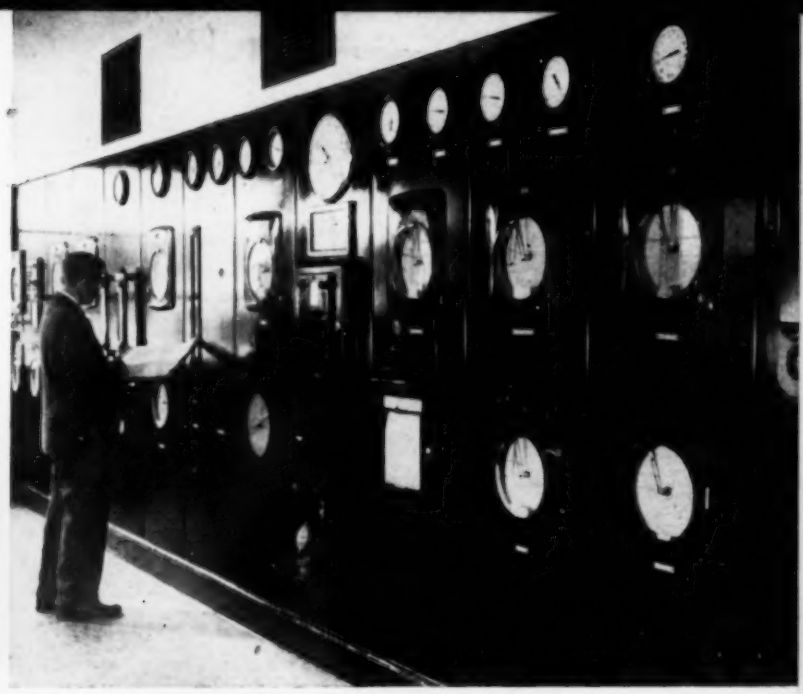
Rock salt, the raw material for the electrolytic alkali-chlorine cells is brought to the plant in carload lots. On arrival it is elevated to the top floor of the brine building, dumped into either of two 30,000-gal. concrete tanks and dissolved to make a saturated solution. This brine is pumped to the purfication system.

Purifying Brine

The treatment for purifying the brine is carried out in three plain steel tanks with the solution cascading from one to another of these tanks. In the first the brine is treated with a solution of sodium carbonate to remove the calcium; a slight excess of carbonate is added. In the second step caustic soda is added to remove magnesium



Distillation towers and still building of plant



Instrumentation plays an important part in control of plant operations

A plant for the production of synthetic phenol from monochlorbenzol by a completely continuous process has been put into operation by the Chemical Department of the General Electric Co. at Pittsfield, Mass. The plant was designed, engineered and constructed by the Lummus Co. after preliminary laboratory and pilot plant work had been accomplished by G.E. In this plant engineers have made use of the most modern equipment and materials. Instrumentation plays an important role.

salts. When sulphates are present a barium salt is added to the brine in the third and final tank. However, this barium treatment is rarely required as there is very little tendency for accumulation of sulphates in the system.

Treated brine flows by gravity to a Clarifloculator where the clarified solution is decanted off from the slurry containing the sludge. Clarified brine liquor goes by gravity to sand filters and is then pumped to storage tanks for use in the cell plant as required.

The temperature of the purified brine is raised to 150 deg. F. in heat exchangers and the solution resaturated with salt, usually purified material from the evaporators. It is then reheated in order to prevent salt precipitating in the distribution mains. The warm saturated brine goes directly to the electrolytic cells.

About a hundred Hooker type S cells make up the installation (for details of the cell refer to "Story of the Hooker Cell," *Chem. & Met.*, July 1938). At the present time the hydrogen produced in the cells is discarded. Chlorine is used for chlorinating the benzol and caustic soda for hydrolyzing the monochlorbenzol.

Caustic soda effluent from the cells is pumped to a cell liquor storage tank and from there to a double-effect Swenson evaporator where it is evaporated to 20 percent. It is then pumped to a settling tank and is separated into a clear, 20 percent solution and a slurry containing the salt. The latter is removed from the slurry on a rotary vacuum filter (nickel screen). The salt crystals are washed on the filter, redissolved in weak brine and reused in saturating the purified brine feed for the electrolytic cells as mentioned above. The caustic goes by gravity to a storage tank in which it is diluted to 10 percent and held for use in hydrolyzing the monochlorbenzol.

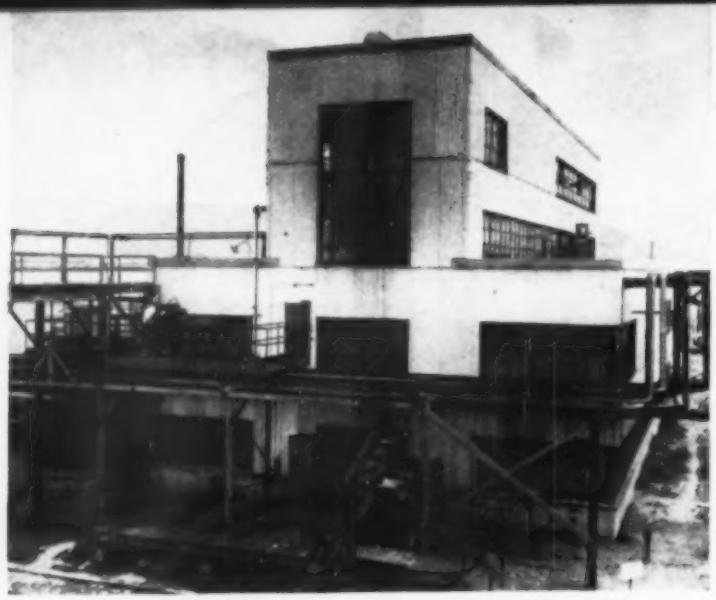
Chlorine Is Treated

Chlorine leaves the electrolytic cells through an opening in the concrete top by means of a chemical stoneware pipe line connected to a header. It leaves the cells at a temperature of 180 deg. F. and is cooled in a glass heat exchanger. Water is used around the first few tubes and brine around the final tubes. The gas leaves the exchanger in stoneware lines at 55 deg. F.

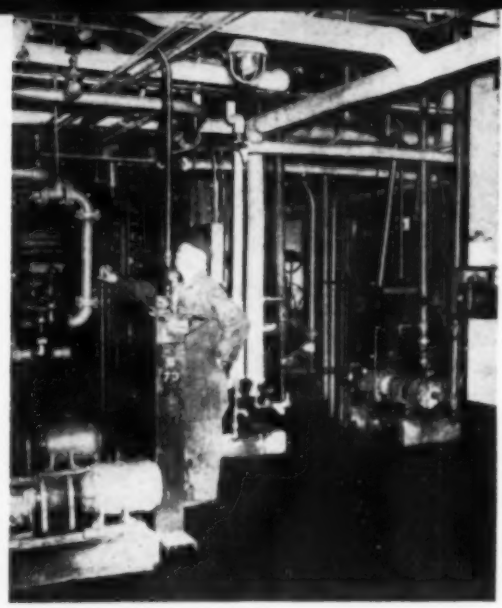
When the gas leaves the coolers it contains moisture equivalent to the vapor pressure of water at 55 deg. and this moisture must be removed if the gas is to be compressed. This drying is accomplished in stoneware drying towers by allowing sulphuric acid to come in intimate contact with the gas in countercurrent flow. For this purpose a Green or cascade tower, also called the "drip" tower, is used. It consists of a bottom and a cover with a number of intermediate sections in between. Each intermediate section is composed of a bell and spigot section approximately 12 in. high with an orifice of about one-fourth the diameter in the center of the bottom of the section and a circular plate with a raised edge which is supported over and overhangs the orifice. Sulphuric acid enters at the top and flows down the tower, forming an absorption surface on the circular plate and the bottom of each section. Chlorine enters at the bottom of the tower and flows up through each orifice and over each absorption surface and is discharged at the top of the tower. In the case of this single pass tower the acid enters at about 95 percent and exists at between 50 and 60 percent. The tower is 48 in. in diameter and 32 sections high.

Drying tower, middle sections

After drying, the gas passes through plain steel pipe lines to Nash compressors (sulphuric acid is used as a sealing liquid). It is compressed to 20



Brine building in which electrolytic cell feed is prepared



Pumping solution in the phenol plant

lb. and goes directly through a steel pipe line to the chlorinator, a cast iron kettle. Here it comes into contact with benzol dried by distillation and pumped continuously to the chlorinator. The benzol is chlorinated to a ratio of 14 parts of monochlor to 1 part of dichlor with an excess of benzol slightly below the boiling point of benzol.

$$C_6H_6 + Cl_2 \rightarrow C_6H_5Cl + HCl$$
$$C_6H_5Cl + Cl_2 \rightarrow C_6H_4Cl_2 + HCl$$

Every effort is made to keep the entire system dry so as to avoid corrosion and to prevent leaks in the equipment. The gases and liquids are dried to less than 30 parts of moisture per million.

There are two exit lines from the chlorinator, one for gas, the other for liquid. Gases leave the chlorinator at 180 deg. F. and are cooled in a shell and tube heat exchanger. Brass and Hastelloy B have been found by experience to be more satisfactory than plain steel, for the latter is more apt to foul up on the water side and thus lower the heat transfer rate. Cooled gases go to a Karbate-tantalum absorber where they are absorbed in water to form 32-33 percent hydrochloric acid employed to neutralize sodium phenolate in the formation of phenol.

Acid is stored in either rubber-lined steel tanks or in concrete tanks lined with brick and sulphur-base cement. For acid lines from the absorber to the storage tanks procelain, glass and Haveg have been found to be satisfactory.

The liquid leaving the chlorinator is composed of 55 percent unreacted benzol, 42 percent monochlorbenzol and 3 percent dichlorbenzols. It is first neutralized with 10 percent caustic by contact in a centrifugal high-speed pump, then it goes to the chlorinated products steel storage tank from which the clear layer is decanted and pumped continuously to the benzol tower. Chlorobenzenes are removed from the bottom of the column and are pumped to another column, the monochlorbenzol tower. The monochlor is distilled off over head and goes to a storage tank; the dichlors are drained off from the bottom and are removed from the system and sold as crude material. These two standard bubble cap towers operate together, the bottom product from the first feeding the second.

Monochlor Converted

Monochlorbenzol and from 10 to 15 percent caustic in the mol-ratio of 2-2½ to 1 are continuously added and mixed in the emulsifying tank. In the same tank is mixed the diphenyl ether which forms as a byproduct in the reactor. This mixture of the three goes to the high-pressure pump and is sent on its way at a pressure of 4,000 lb. per sq.in. In the carbon-moly steel heat exchanger the temperature of the mixture is raised to 500 deg. F. It then goes to the reactor and the temperature is further increased to 700 deg. F. The heater is a temperature controlled oil fired furnace. Formerly carbon-molybdenum steel was used but since the corrosion rate is high other materials are being tried with very considerable success.

The feed first enters the radiant section of the tubular reactor and the temperature is brought up to reaction temperature. In the convection section the reaction mixture is held at the high temperature until the reaction is complete. Substantially all monochlor is reacted to sodium phenolate, diphenyl ether or high boiling residues.

$$C_6H_5Cl + 2\,NaOH \rightarrow C_6H_5ONa + H_2O + NaCl$$
$$C_6H_5Cl + C_6H_5ONa \rightarrow (C_6H_5)_2O + NaCl$$

From 10 to 15 percent of the by-product $(C_6H_5)_2O$ is produced per pass through reactor.

From the reactor the mixture is cooled, pressure is reduced to atmospheric and the mixture goes to the decanter where the diphenyl ether (amounting to about 2 percent) is separated from the sodium phenolate. The former is recycled back to the heater via the emulsifyer, etc., so as to prevent a build-up in the system. The sodium phenolate is continuously neutralized with the hydrochloric acid from the chlorinator in a glass-lined tank equipped with a stirrer. Neutralization is automatically controlled at a pH of between 6 and 7 by a pH recorder-controller.

$$NaOC_6H_5 + HCl \rightarrow NaCl + C_6H_5OH$$

There are two layers formed by this reaction, a brine layer and a phenol-water layer. The former contains about 17 percent sodium chloride and 1¼ percent phenol. The phenol in the brine layer is recovered by distillation in a tower. This weak brine from the tower is filtered through sand beds to remove material in suspension and then made slightly acid. Next it is passed through activated carbon to remove traces of primary phenol and other organic material. The purified brine goes to storage for use in cell feed. Water-phenol comes off the top of the tower and goes to the sodium phenolate storage tank. The phenol-water goes to the continuous distillation tower. All water and the small volume of phenol go off overhead to the sodium phenolate storage tank. The bottoms product is the dry phenol and high-boiling residues. These pass to the batch kettle of a phenol tower which operates continuously until the batch kettle becomes full of residue when the batch kettle is drained. In other words the phenol still operates semi-continuously under vacuum. Pure phenol (40.4 deg. C. C.m.p.) goes off overhead to the steel storage tank. It is later shipped in steel tank cars to the resin plant a few miles distant.

has a negligible effect on the power and that the power varies directly as the density of the solution. However, since the densities of most commonly-met-with solutions are all about the same, the density factor may also be neglected for approximations. In other words, for gas-liquid contacting, the power drawn in water will be nearly the same for any other liquid and an impeller designed to operate in water will perform roughly the same in other liquids.

Example 4 (Design with no pilot plant data)—1,000 gal. of an aqueous slurry of a metallic hydroxide at 70 deg. F. is to be converted to the carbonate by contacting with flue gas containing 20 percent CO_2. It is desired to design reasonably-efficient agitation equipment to do this job and to estimate its performance.

Since better power efficiency is obtained by using a tall tank, a tank will be selected in which the liquid depth will be twice the tank diameter. The tank size and dimensions will be:
1,000 gal. = 134 cu.ft. = $[(2D)\pi D^2]/4$
where D = 4.4 ft. tank diameter; $2D$ = 8.8 ft. liquid depth; $D/3$ = 18 in. impeller diameter = L. These tank dimensions will allow two impellers to be used on the shaft; therefore, a superficial velocity of 500 ft. per hr. maximum can safely be used. The volume of gas used would then be:
$[(500)\pi(4.4)^2]/4 = 7{,}600$ cu.ft. per hr. (20 percent CO_2, 70 deg. F. = 3.9 lb. mol CO_2 per hr.
Operating power per cu.ft. of solution can vary between 0.01 and 0.10 hp. per cu.ft. (Fig. 3). A value of 0.03 is chosen to give a reasonable-size stirrer. Reading from the chart at hp./v = 0.03, operating power demand and 500 ft. per hr. gas velocity, gives a K_v of 0.115 [lb. mol]/[(hr.)(ft.)^3(atm.)]

$$\text{or for } \frac{\text{liquid depth}}{\text{tank diameter}} = 2,$$
$$K_v = 0.115 \times 1.5 = 0.172$$

The CO_2 pressure at the bottom of the tank will be:
$0.20\ [14.7 + (8.8)\ (0.435)] =$
3.7 lb. per sq.in. = 0.252 atm.
Let the CO_2 pressure at the top of the tank be p atm. Then the amount of CO_2 absorbed will be:

$$\left(\frac{0.2}{0.8} - \frac{p}{1-p}\right) = w \text{ lb. mol. per hr.}$$

The overall equation for the absorption is then:

$w = K_v V \Delta p_m$ or:

$$\frac{(7600)\ (0.08)}{390}\left(\frac{0.2}{0.8} - \frac{p}{1-p}\right) = (0.172)\ (134)\left(\frac{0.252 - p}{2.3 \log \frac{0.252}{p}}\right)$$

p = 0.055 atm. or 5.2 percent CO_2 in the exist gas. w = 2.96 lb. mol per hr. or 76 percent of the CO_2 is absorbed. The power consumed during operation is. (0.03 (134) = 4.0 hp. The power these impellers would draw when the gas is not flowing is found from the chart to be: (0.115) (134) = 15. hp.

The specification for the stirrer will be:
Number of impellers = 2; diameter of impellers = 18 inches; power running in water = 15.5 hp. (total for two impellers); speed = any speed to give the necessary power.

Scaling-Up

Example 5 (Scale-up of pilot plant data)—A non-volatile oil is being "sweetend" continuously by blowing it with air and agitating. The pilot plant data are:

Tank size: Diam = 1 ft.; liquid height = 1 ft.
Volume = 0.785 cu.ft.
Liquid flow rate: 0.1 cu.ft. per min.
Gas flow rate: 5 cu.ft. per min.
Impeller power in water (manufacturer's data): 0.05 hp. Design a system to process 20 gal. of oil per min. (2.68 cu.ft. min.).

This is a process of desorption or stripping and can be handled the same way as absorption. If each volume of oil is treated with the same volume of gas and for the same time, the degree of processing should be identical.

The liquid retention in the pilot plant tank is: 0.785/0.1 = 7.85 min. To secure the same time of contact in the larger tank it must have a volume of (7.85) (2.68) = 21 cu.ft. With height of liquid equal to tank diameter, this would require a tank three feet in diameter.

For the pilot-plant stirrer the "water horsepower" per cu.ft. is 0.05/0.785 = 0.0638. The superficial gas velocity is (5)(60)/0.785 = 382 ft. per hr. If the same gas velocity is used in the larger tank the "water horsepower" per unit volume will be the same or the total power needed will be (0.0636)(21) = 1.34 horsepower.

The gas flow will be: $\pi(383)(3)^2/(60)(4)$ = 45 cu.ft. per min. Note that the cubic feet of air per cubic foot of liquid has decreased. This decrease in rate is exactly compensated for by the fact that the gas is traveling through a greater height of liquid in the larger tank and consequently is in contact for a longer time. A comparison of the two pieces of equipment is given in the following table.

	Pilot	Plant
Tank size	1 ft x 1 ft.	3 ft. x 3 ft.
Liquid volume	0.785 cu. ft.	21.0 cu. ft.
Liquid rate	0.1 cu. ft. per min.	2.68 cu. ft. per min.
Gas rate	5 cu ft. per min.	45 cut ft. per min.
Impeller "water" power	0.05 h.p.	1.34 h.p.

Example 6 (Redesign of existing equipment)—It is required that the performance of a gas absorber be changed to increase the rate of gas absorption. This can be done in two ways: (1) Increase the power per cubic foot of liquid by: (a) putting more blades on the turbine. (b) changing to a larger diameter turbine. (c) increasing the turbine speed; and by (2) increasing the gas flow rate.

By the first method, any increase in power per cu.ft. of liquid will give a corresponding increase in absorption coefficient; that is, double the power and the coefficient will be approximately doubled. This does not necessarily mean that the amount of gas absorbed will be doubled, because the coefficient is on the basis of "per unit of driving force" and as more gas is absorbed the driving force will become less. The resulting amount absorbed will, therefore, be somewhat less than twice as much. The increase in power obtained by increasing the speed or the impeller diameter (holding to geometrically-similar impellers) can be anticipated by the equation: $P_1/P_2 = (N_1/N_2)^3(L_1/L_2)^5$

Secondly, increasing the gas flow will do two things: (a) It will increase the amount of gas available for absorption; (b) it will decrease the power per cu.ft. of liquid since the power consumed decreases as the gas flow increases (at constant impeller speed).

If the impeller speed is not changed, the absorption coefficient will vary with the gas rate according to the following: From the data in Fig. 3, $K_v = c\ (\text{gas rate})^{0.25}$, e.g. doubling the gas rate (at constant stirrer speed) will give a 21 percent increase in K_v.

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ESTIMATING
Magnesia Insulation Costs

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THIS THIRD OF A SERIES EXPLAINS HOW AND WHEN MAGNESIA CAN BE USED WITH ECONOMY AS AN INSULATING MATERIAL IN A PLANT

PROCESS EQUIPMENT COSTS

This is a continuation of the series of articles on estimation of insulation costs, prepared by Mr. Otto. The first, dealing with cork insulation for cold lines and equipment, appeared in our May issue. The second, dealing with mineral wool insulation, appeared in July. This installment discusses magnesia pipe covering and insulating shapes.

MAGNESIA thermal insulants in form of pipe covering and blocks are commonly known as 85 percent magnesia* and under that name have set insulation standards for almost 50 years. The insulation effect is high and the material has, in spite of its light weight, great structural strength. When properly applied it will withstand shock and vibration to a greater extent than a large number of other thermal insulants. It will not shrink when applied on hot surfaces not exceeding 600 deg. F. and it will not sag when properly protected from moisture. Government and industrial specifications are available covering the physical and chemical properties of this material. However, the estimator does not need to consult these specifications for references or for a check on the quality of the material to be purchased since all producers make a fairly uniform product. Abstracts of the specifications involved will therefore not be given in this article.

Purely from the standpoint of thermal efficiencies, magnesia insulants have nothing to fear from insulants made from other raw materials. It is only in cases where the weight of the insulant, the ease of installation, prevailing atmospheric conditions, cleanliness during the process of installing pipe covering and blocks, and other external factors are involved, that the estimator will make comparisons between magnesia type insulants and other available insulation materials. Magnesia is unsuited for cold insulations and should not be used for temperatures below 100 deg. F. It is ideally adapted to low-pressure and high-pressure lines and equipment; super-pressure equipment and pipes can be insulated with magnesia if a high temperature material is used between hot surface and magnesia.

Magnesia Pipe Covering

The density and insulating efficiency of 85 percent magnesia insulants (hereinafter referred to as magnesia insulants) vary in accordance with the manufacturing methods employed. Some manufacturers prefer a greater density and higher mechanical strength, whereas other manufacturers prefer higher thermal efficiency combined with lower density and therefore less weight on the pipe. For design purposes the engineer should use a weight of 15 lb. per cu. ft.; the manufacturer of magnesia pipe covering will furnish upon request tables containing the net weights of pipe covering for the various pipe sizes and for the various thicknesses.

Magnesia pipe covering is supplied in lengths of 3 ft., therefore orders should always be totaled to a figure which can be divided by three. The covering is supplied in six wall thicknesses, for which the following terms have been standardized: Standard, 1¼ in., 2 in., 2½ in., Double Standard, and 3 in. Where thicknesses greater than 3 in. are desired, two or more layers may be used with each layer individually wired to the surface. Thicknesses of Standard and Double Standard vary with the pipe sizes for which the covering is intended. Actual thicknesses are listed in Table I from which it will be noted that Double Standard is furnished in two layers. Designers should pay particular attention to the various thicknesses for the different pipe sizes in order to provide for the necessary clearance between pipes running parallel or close

Table I—Standardized Thickness of 85 Percent Magnesia Pipe Covering

Classification	Pipe Size, Inches	Wall Thickness, Inches
Standard	1/2 to 1 1/2	7/8
	2 to 3 1/2	1 1/32
	4 to 6	1 1/8
	7 to 10	1 1/4
	11 to 33	1 1/2
1 1/2 In.	1/2 to 33	1 1/2
2 In.	1/2 to 33	2
2 1/2 In.	1/2 to 33	2 1/2
Double Standard	1/2 to 33*	same as Standard
	1/2 to 1 1/2†	1 1/32
	2 to 6†	1 1/8
	7 to 10†	1 1/4
	11 to 33†	1 1/2
3 In.	1/2 to 33*	1 1/2
	1/2 to 33†	1 1/2

* Inside layer † Outside layer

* Insulating material known as 85 percent magnesia is called so because, when manufactured by a known and reliable producer, it contains approximately 85 percent pure basic magnesium carbonate, the remaining 15 percent being made up of asbestos fiber as binder and adhesives. Pipe covering and blocks are molded, dried and machined to exact sizes, whereas cement and bulk magnesia is dried and comminuted to the desired fineness.

Table II—Inside Diameter of 85 Percent Magnesia Pipe Covering

Pipe Size, Inches	Inside Diameter of Pipe Covering, Inches
1/2	7/8
3/4	1 1/8
1	1 3/8
1 1/4	1 3/4
1 1/2	1 15/16
2	2 7/16
2 1/2	2 15/16
3	3 9/16
3 1/2	4 1/16
4	4 9/16
4 1/2	5 1/16
5	5 5/8
6	6 3/4
7	7 3/4
8	8 3/4
9	9 7/8
10	10 7/8
11	11 7/8
12	12 7/8
14 to 33	same as pipe size

Table III—Outside Diameter of Magnesia-Covered Pipes, Inches

Pipe Size, In.	Standard Thickness	Double Standard	1½ In. Thick	2 In. Thick	2½ In. Thick	3 In. Thick
1/2	2 5/8	4 11/16	3 7/8	4 7/8	5 7/8	6 7/8
3/4	2 7/8	4 15/16	4 1/8	5 1/8	6 1/8	7 1/8
1	3 1/8	5 3/16	4 3/8	5 3/8	6 3/8	7 3/8
1 1/4	3 1/2	5 9/16	4 3/4	5 3/4	6 3/4	7 3/4
1 1/2	3 11/16	5 3/4	4 15/16	5 15/16	6 15/16	7 15/16
2	4 1/2	6 3/4	5 7/16	6 7/16	7 7/16	8 7/16
2 1/2	5	7 1/4	5 15/16	6 15/16	7 15/16	8 15/16
3	5 5/8	7 7/8	6 9/16	7 9/16	8 9/16	9 9/16
4	6 13/16	9 1/16	7 9/16	8 9/16	9 9/16	10 9/16
6	9	11 1/4	9 3/4	10 3/4	11 3/4	12 3/4
8	11 1/4	13 3/4	11 3/4	12 3/4	13 3/4	14 3/4
10	13 3/8	15 7/8	13 7/8	14 7/8	15 7/8	16 7/8
12	15 7/8	18 7/8	15 7/8	16 7/8	17 7/8	18 7/8
16	19	22	19	20	21	22
20	23	26	23	24	25	26
24	27	30	27	28	29	30
30	33	36	33	34	35	36
32	35	38	35	36	37	38

Table IV—Guide for Thickness of 85 Percent Magnesia Pipe Covering*

(Cold side in 70 deg. F. air)

Pipe Size, In.	Temperature of Hot Surface, Deg. F. 400	500	600
	Wall Thickness of Pipe Covering		
1	1½ in.	2 in.	2 in.
2	1½ in.	2 in.	2 in.
3	1½ in.	2 in.	2 in.
4	1½ in.	2 in.	2 in.
5	2 in.	D. Std.	D. Std.
6	2 in.	D. Std.	D. Std.
8	2 in.	D. Std.	D. Std.
10	2 in.	D. Std.	D. Std.
12	2 in.	D. Std.	D. Std.
14	2 in.	D. Std.	D. Std.
16	2 in.	D. Std.	D. Std.
18	2 in.	D. Std.	D. Std.
20	2 in.	D. Std.	D. Std.

* For all pipe sizes vs. 300 deg. F. and lower hot side temperature use standard thickness.

Table V—Thermal Coefficient for Magnesia Blocks and Pipe Covering

Mean Temp., Deg. F.	*k*-Factor, B.t.u./Sq. Ft., Hr., Deg. F., per In. Manufacturers' Product Number 50	51	52	53
100	0.38	0.43	0.42	0.45
200	0.43	0.48	0.46	0.48
300	0.48	0.52	0.50	0.53
400	0.53	0.57	0.54	0.57
500	0.58	0.62	0.58	0.61
600	0.63	0.66	0.63	0.64
650	0.65	0.68	0.65	0.65

Table VI—Heat Losses* and Efficiencies of Standard Thickness Magnesia

(Room temperature, 70 Deg. F.)

Pipe Size, In.	Temperature Difference Between Hot Pipe and Ambient Air, Deg. F. 100 B.t.u. Loss	100 Eff. %	200 B.t.u. Loss	200 Eff. %	300 B.t.u. Loss	300 Eff. %	400 B.t.u. Loss	400 Eff. %	500 B.t.u. Loss	500 Eff. %
1/2	0.750	72.23	0.800	75.08	0.850	77.87	0.900	80.31	0.950	82.44
3/4	0.695	72.96	0.738	75.96	0.782	78.75	0.825	81.33	0.870	83.43
1	0.637	74.52	0.678	77.40	0.718	80.01	0.760	82.49	0.802	84.45
1 1/4	0.580	76.32	0.619	78.94	0.658	81.41	0.696	83.73	0.732	85.61
1 1/2	0.552	77.09	0.589	79.69	0.626	82.11	0.663	84.09	0.700	86.08
2	0.471	80.00	0.501	82.42	0.530	84.61	0.559	86.56	0.590	88.15
2 1/2	0.443	80.65	0.473	83.00	0.503	85.07	0.531	87.00	0.560	88.60
3	0.420	81.34	0.449	83.56	0.474	85.68	0.503	87.52	0.535	88.97
4	0.369	83.15	0.399	85.00	0.431	86.39	0.462	88.30	0.495	89.62
6	0.348	83.67	0.376	85.49	0.403	87.32	0.430	88.95	0.460	90.19
8	0.309	85.22	0.330	87.11	0.354	88.72	0.377	90.23	0.399	91.44
10	0.303	85.36	0.323	87.29	0.343	89.00	0.364	90.52	0.385	91.70
12	0.270	86.83	0.285	88.69	0.305	90.16	0.320	91.66	0.334	92.76
14	0.267	86.91	0.280	88.80	0.300	90.25	0.315	91.69	0.330	92.81
16	0.263	87.05	0.277	88.83	0.295	90.36	0.312	91.72	0.327	92.84
18	0.260	87.13	0.274	88.91	0.292	90.43	0.309	91.76	0.323	92.90
20	0.572	87.21	0.271	88.98	0.289	90.49	0.306	91.81	0.320	92.93

* Heat losses are expressed in B.t.u. per square foot of pipe surface per hour per degree of temperature difference between pipe and air. The heat losses and efficiencies for other temperature differences may be obtained by interpolation or proportioning.

to walls, ceilings or equipment. For pipes from ½-in. up to and including 12-in. magnesia pipe covering is furnished in sectional or semi-circular form with factory applied canvas jacket and metal bands. This factory applied canvas is actually only a very light weight loose textile of the muslin type and should not be confused with the regular 8-oz. canvas, commonly employed when the pipe covering is to be protected by "canvas sewed on." In the case of outer layers of 3-in. thick covering for 9-in. pipes and up, and outer layers of Double Standard for pipes of 10 in. and up, these outer layers are furnished in segments. Magnesia pipe coverings for pipes of 12 in. and up are always furnished in segmental form, except that the single layer 12-in. covering is available in sectional form upon special request. All segments are approximately 5 in. wide along the inner arc and the manufacturer will make certain that all the segments for one pipe size will fit snugly and exactly around the pipe without the use of an odd-width segment. The usual factory applied canvas and the metal bands are not furnished with segments.

Quite frequently maintenance departments which take care of pipe covering jobs in industrial plants find themselves out of certain sizes of magnesia pipe covering and with an excess of other sizes because helpers and unexperienced workmen assigned to do the insulating job apply the wrong sizes. It is good policy to supply each workman with a 12-in. rule and with a copy of Table II. If the man is in doubt whether a pipe is of 3 or 3½-in. diameter, he may with the help of an outside caliper make certain of the size, and by consulting his copy of Table II will know whether he needs a sectional covering of $3\frac{9}{16}$ or $4\frac{1}{16}$-in. inside diameter.

Another difficulty frequently arises in insulation work. This is the failure of the design engineer or draftsman to allow for sufficient clearance between pipes or between pipes and neighboring surfaces. Table III lists, for pipes from ¼-in. to 32-in. size, and for all standardized wall thicknesses, the outside diameter of the pipe after the insulation has been applied. For example, a 6-in. pipe after insulation has been installed will have diameters of 9, 9¾, 10¾, 11¼, 11¾ or 12¾ in. depending on what wall thickness of cov-

Table VII—Heat Savings in B.t.u. per Lineal Foot per Hour, by Recommended Thicknesses*

(Room air temperature, 70 deg. F.)

Pipe Size,	Temperature of Hot Surface, Deg. F.				
In.	200	300	400	500	600
1	64	160	315	527	798
2	117	293	562	938	1422
3	168	418	803	1351	2058
4	215	533	1015	1714	2617
5	262	649	1276	2116	3227
6	310	769	1516	2522	3835
8	403	1009	1958	3286	5000
10	498	1249	2430	4085	6216
12	595	1495	2870	4849	7381
14	650	1625	3126	5288	8059
16	740	1843	3553	6013	9171
18	831	2070	3992	6747	10296
20	919	2291	4417	7471	11383

* See Table IV for recommended thicknesses.

Table IX—List Prices for 85 Percent Magnesia Pipe Covering

(Basis, dollars per lineal foot)

Pipe Size,	Standardized Wall Thickness of Covering					
				Double		
In.*	Standard	1½ In.	2 In.	Standard	2½ In.	3 In.
½	0.22	0.46	0.75	0.65	1.00	1.20
¾	0.24	0.49	0.80	0.70	1.05	1.35
1	0.27	0.52	0.85	0.75	1.10	1.40
1¼	0.30	0.56	0.90	0.80	1.15	1.45
1½	0.33	0.60	0.95	0.85	1.20	1.55
2	0.36	0.64	1.00	0.90	1.25	1.65
2½	0.40	0.70	1.05	1.00	1.35	1.75
3	0.45	0.76	1.15	1.10	1.50	1.90
3½	0.50	0.82	1.25	1.20	1.65	2.05
4	0.60	0.88	1.35	1.40	1.80	2.20
4½	0.65	.94	1.45	1.50	1.95	2.35
5	0.70	1.00	1.55	1.60	2.10	2.50
6	0.80	1.10	1.70	1.80	2.25	2.70
7	1.00	1.20	1.85	2.25	2.40	2.90
8	1.10	1.35	2.00	2.50	2.55	3.15
9	1.20	1.50	2.20	2.70	2.80	3.40
10	1.30	1.65	2.40	2.90	3.05	3.65
11	1.75	1.75	2.55	3.50	3.20	3.90
12	1.85	1.85	2.70	4.10	3.40	4.10
14	2.10	2.10	3.00	4.60	3.80	4.60
15	2.25	2.25	3.15	4.85	4.00	4.85
16	2.35	2.35	3.30	5.10	4.20	5.10
17	2.50	2.50	3.45	5.35	4.40	5.35
18	2.60	2.60	3.60	5.60	4.60	5.60
19	2.75	2.75	3.80	5.80	4.80	5.80
20	2.85	2.85	4.00	6.00	5.00	6.00
21	3.00	3.00	4.15	6.25	5.20	6.25
22	3.10	3.10	4.30	6.50	5.40	6.50
23	3.20	3.20	4.40	6.75	5.60	6.75
24	3.30	3.30	4.50	7.00	5.75	7.00
26	3.55	3.55	4.85	7.50	6.20	7.50
27	3.65	3.65	5.05	7.70	6.40	7.70
28	3.75	3.75	5.15	7.95	6.65	7.95
30	4.00	4.00	5.50	8.40	6.95	8.40
32	4.30	4.30	5.90	9.10	7.40	9.10
33	4.40	4.40	6.05	9.20	7.60	9.20

* Sizes ½ to 12 in. are nominal; 14 in. and larger are O.D.

Table VIII—Cost of 1 Million B.t.u. in Various Fuels

Fuel	Heat Content of Fuel	Purchase Price of Fuel, Dollars	Cost of 1 Million B.t.u., Dollars
Fuel Oil	152,000 B.t.u. gal.	0.023 [1]	0.15
		0.030 [1]	0.20
		0.038 [1]	0.25
		0.046 [1]	0.30
		0.061 [1]	0.40
		0.91 [1]	0.60
Fuel Gas	1,000 B.t.u. cu.ft.	0.15 [2]	0.15
		0.20 [2]	0.20
		0.25 [2]	0.25
		0.30 [2]	0.30
		0.40 [2]	0.40
		0.60 [2]	0.60
Fuel Gas	600 B.t.u. cu.ft.	0.25 [2]	0.15
		0.33 [2]	0.20
		0.42 [2]	0.25
		0.50 [2]	0.30
		0.67 [2]	0.40
		1.00 [2]	0.60
Coal	13,000 B.t.u. lb.	3.90 [3]	0.15
		5.20 [3]	0.20
		6.50 [3]	0.25
		7.80 [3]	0.30
		10.40 [3]	0.40
		15.60 [3]	0.60
Steam	1,200 B.t.u. lb	0.18 [4]	0.15
		0.24 [4]	0.20
		0.30 [4]	0.25
		0.36 [4]	0.30
		0.48 [4]	0.40
		0.72 [4]	0.60

[1] per gal. [2] per 1,000 cu.ft. [3] per ton [4] per 1,000 lb.

ering has been applied. It is good practice to add another ¼-in. clearance for design purpose. This enables painters to paint the canvas not only for the eye, but all around for lasting protection.

Too often the selection of the proper wall thickness of an insulation is not based on thermal calculations but on rule of thumb. A number of people responsible for heat savings are under the erroneous impression that a Standard Thickness is a cure-all for standard conditions. That is not so. A Standard Thickness never will return the full possible savings if the pipe is hotter than 300 deg. F. It is necessary to consult Table IV for that thickness which is a minimum for the full savings which a well applied magnesia pipe covering is able to return. These thicknesses are the combined results of practical experience and theoretical heat transfer calculations. The estimator should not permit the application of thicknesses below those recommended in Table IV.

The heat savings to be achieved from magnesia insulations are usually uniform, regardless of whose brand of pipe covering is installed. Table V lists the thermal coefficients for four different brands of 85 percent magnesia pipe covering and blocks.

Heat Losses

Table VI lists the efficiencies and heat losses for pipes from ¼ to 20 in. when covered with Standard Thickness, such heat losses expressed as B.t.u. per square foot of pipe surface per hour per degree temperature difference between the hot pipe and the air in the room. Table VI shows that losses are highest for small pipes and lower temperatures and that efficiencies increase with pipe diameter and temperature. Estimators may use these figures to bring the total expenditure for a contemplated insulation job in line with the heat savings attainable.

A quick calculation of possible savings from insulation may be had by consulting Table VII which gives the total B.t.u. savings per lineal foot of pipe per hour for the various temperature differences and for all pipe sizes from 1 in. to 20 in. when insulated with 85 percent magnesia pipe covering of recommended wall thicknesses. To arrive at the dollar value of heat savings estimators may consult

Table XI—Cost of Installing Standard Thickness 85 Percent Magnesia Pipe Covering

(Basis, dollars per lineal foot)

Pipe size, In.	Canvas*	Paper†
1/2	0.35	1.01
3/4	0.37	1.03
1	0.39	1.05
1 1/4	0.41	1.08
1 1/2	0.43	1.11
2	0.45	1.14
2 1/2	0.47	1.17
3	0.49	1.21
4	0.51	1.26
5	0.57	1.35
6	0.62	1.38

* Factory-applied canvas pasted down; two metal bands per ft.

† Rosin-sized paper over magnesia; 8 oz. canvas sewed on.

Table XII—Heat Losses* and Efficiencies of Magnesia Block Insulation

(Room air temperature, 70 deg. F.)

Thickness of Insulation, In.	Temperature of Hot Surface, Deg. F. 170 B.t.u. Loss	170 Eff. %	270 B.t.u. Loss	270 Eff. %	370 B.t.u. Loss	370 Eff. %	470 B.t.u. Loss	470 Eff. %	570 B.t.u. Loss	570 Eff. %
None	1.920	0	2.350	0	2.900	0	3.560	0	4.320	0
1	0.340	82.29	0.357	84.81	0.375	87.07	0.392	89.00	0.410	90.51
1½	0.236	87.71	0.250	89.36	0.264	90.90	0.278	92.20	0.292	93.24
2	0.185	90.37	0.195	91.70	0.206	92.90	0.217	93.91	0.228	94.72
2½	0.151	92.14	0.160	93.19	0.169	94.18	0.178	95.01	0.187	95.67
3	0.128	93.34	0.135	94.25	0.142	95.11	0.149	95.82	0.157	96.36
3½	0.114	94.07	0.120	94.89	0.126	96.66	0.133	96.27	0.139	96.78
4	0.104	94.59	0.109	95.36	0.114	96.07	0.120	96.64	0.126	97.08

* B.t.u. heat losses are expressed in B.t.u. per square foot, per hour, per degree temperature difference between room air and hot metal surface.

Table X—Square Feet of Canvas per Lineal Foot of Pipe Covering

Pipe Size, In.	Thicknesses of 85 Percent Magnesia Pipe Covering: Standard	Dbl. Std.	1½ In.	2 In.	2½ In.	3 In.
½	0.688	1.229	1.014	1.276	1.537	1.797
¾	0.753	1.293	1.080	1.342	1.604	1.866
1	0.818	1.358	1.145	1.407	1.678	1.930
1¼	0.917	1.456	1.244	1.505	1.767	2.028
1½	0.964	1.505	1.293	1.555	1.816	2.078
2	1.117	1.767	1.424	1.865	1.947	2.209
2½	1.307	1.900	1.555	1.816	2.078	2.340
3	1.471	2.063	1.718	1.980	2.242	2.503
4	1.781	2.372	1.980	2.242	2.503	2.765
6	2.360	2.943	2.553	2.815	3.076	3.338
8	2.943	3.599	3.076	3.338	3.599	3.861
10	3.537	4.156	3.633	3.894	4.156	4.481
12	4.156	4.941	4.156	4.418	4.680	4.941
16	4.974	5.759	4.974	5.236	5.498	5.759
20	6.021	6.807	6.021	6.283	6.545	6.807
24	7.068	7.853	7.068	7.330	7.592	7.853
30	8.633	9.417	8.633	8.900	9.158	9.417
32	9.158	9.942	9.158	9.417	9.684	9.942

Table VIII which lists the costs of 1,000,000 B.t.u. when using fuel oil, fuel gas, coal, or where the cost of steam is known. Table VIII gives the cost of 1,000,000 B.t.u. at 15, 20, 25, 30, 40 and 60 cents and six purchase prices have been given for each fuel. By interpolation the exact cost for 1,000,000 B.t.u. may be ascertained for each individual plant if the cost of fuel is known.

After the estimator has decided what type of thermal insulant he wishes to recommend and after the thickness of insulation has been determined in the light of possible savings and monetary returns, purchase of the necessary quantities of pipe covering will be the next step. In order to arrive at correct figures it is necessary to have a "take-off" made. The best method, as experienced by the writer, is a bill of material on the piping drawing itself, made by the man who made the drawing.

An order for magnesia pipe covering will be invoiced at delivered prices as listed in Table IX and is subject to various discounts. At the present time a discount of 34 percent is applicable to most sections of the United States. To arrive at a total cost for the entire job the estimator has to add to the cost of the pipe covering itself hauling charges, scaffolding, breakage and labor cost. Where 8-oz. canvas is required the cost of the canvas and the extra labor time for sewing must be added. The necessary yardage of canvas may be calculated from Table X which gives the area in sq. ft. per lineal ft. of pipe measured over the insulation; approximately 10 percent must be added for the folding or lapping of the canvas, and when shop labor is employed for the application of canvas it is good policy to add another 5 percent for wastage. The same addition of 10 percent and 5 percent holds true if the pipe is outdoors and must be protected from the influence of the weather by a layer of 65-lb. roofing felt, white-top asbestos felt, or sheet metal. Table X may also be used to determine the quantity of paint required for the coating of the finished pipe covering.

Installation Cost

Estimators may be spared the job of calculating the cost of accessories and labor by referring to Table XI which gives him the cost of the installation work including hauling, scaffolding, wastage and accessories. This does not include the cost of the insulation material itself. Total cost of the installation is the sum of the net cost of the magnesia pipe covering delivered to the plant plus the figures quoted in Table XI. Cost of installation as given in Table XI is based upon the new wage scale for the pipe coverers of $2.75 per hour, whereas the cost of installing corp pipe covering and mineral wool pipe covering given in two preceding articles (*Chemical Engineering*, May 1947, page 120; July 1947, page 105) were based upon a wage scale of $2 per hr. Cost of insulating fittings and valves may be taken as 2 lin. ft. of pipe of the corresponding size.

For insulation of equipment, 85 percent magnesia is available in form of flat blocks, curved blocks, lagging, and special shapes, wedges, tapered pieces, and in any other form when a drawing is available. Regular thickness of magnesia blocks is from 1 in. to 4 in. in increments of ½ in. Blocks of 12-in. width are furnished in thicknesses from 1½ in. up because of greater damage to blocks of smaller thickness. Standard widths of magnesia blocks are 3, 6 and 12 in. and the standard lengths are 18 and 36 in. The average weight of magnesia blocks should be taken as 1.25 lb. per board ft. The minimum thickness of curved blocks is 1¼ in. and the maximum thickness is that which can be cut from a 4-in. thick flat block. When ordering curved blocks, the outside diameter of the equipment to be covered must be specified.

Specifications covering physical and chemical characteristics of magnesia blocks are practically identical with those promulgated for magnesia pipe covering. The recommended thicknesses for best results and greatest economy are 1½ in. for hot equipment

(*Continued on page 133*)

Engineering Approach to Preliminary COST ESTIMATES

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THE SYSTEMATIC METHODS OF PRELIMINARY COST ESTIMATING THAT ARE DISCUSSED PAY DIVIDENDS IN THE ACCURACY THEY ACHIEVE

PROCESS EQUIPMENT COSTS

ALTHOUGH THE early stages in the design work for process industry plants involve various kinds of related preliminary engineering, such as the development of process and engineering flow sheets, materials and energy balances, and plot plans and equipment arrangement drawings, the only phase of this early work to be discussed here is the pre-construction or preliminary cost estimate. This article deals with the methods used by an independent engineering and construction firm in preparing such estimates, but these methods seem nevertheless to be generally useful, with only a few changes needed, such as the inclusion of land cost (ordinarily not part of the engineer's contract with his client), to adapt them to the needs of chemical plant engineering departments.

Approach to Estimation

A preliminary estimate is usually assembled from a minimum of information. The essential information that must, in general, be assembled for the preparation of a preliminary estimate consists of the following:

1. *Site Plan*—The proposed site plan is reviewed and the site and surrounding property inspected to obtain information for preparing a preliminary plot plan and for estimating yard improvements and utility lines to the site.

2. *Process Flow Sheet*—The preliminary process or chemical flow sheet is reviewed with the client. Ordinarily this sheet does not give the size of each piece of equipment or the number of units required. In addition, it may not show accessory equipment for large process units, such as dryers, thickeners or filters.

3. *Preliminary Engineering Flow Sheet*—A preliminary engineering flow sheet must now be roughed out on sketch paper, indicating each piece of equipment, its size, and its materials of construction.

4. *Preliminary Plot and Equipment Arrangement Plans*—These plans are also roughed out on sketch paper to give approximate building sizes and other information required for the preparation of the preliminary estimate.

5. *Preliminary Equipment and Instrument Lists*—These lists are prepared from the preliminary engineering flow sheet and are used for pricing equipment and instruments.

6. *Preliminary Material and Energy Balances*—If the process flow sheet gives sufficient information on the flow of materials, only balances for steam, water, electricity and other utilities are prepared to assist in estimating service facilities. Otherwise, at least a complete material balance must be made.

After the preliminary estimate has been presented then, if the client's decision is to proceed with design and construction, the next step is the preparation of an official or fee basis estimate. For this purpose it is necessary for drawings to be sufficiently advanced for accurate quantity take-offs. During this stage the client frequently requests changes in the scope of the work, and these changes often account for the principal part of the difference between official and preliminary estimates.

The Summary Sheet

The preliminary estimate customarily employs a summary sheet listing major items of construction cost. A group of detail sheets attached to the summary sheet give the breakdown of the cost of each of the items. A sample form for such a typical summary sheet is given in Table I. Items A to K are the major subdivisions of design and construction work. The sum of items A to F is the Total Physical Cost. The sum of items G to K will be referred to as Total Other Cost. The sum of Total Physical Cost and Total Other Cost is, of course, the total cost exclusive of fee, or simply the total cost. Total Physical Cost

In this first of two articles the author explains how preliminary plant cost estimates are made by a large engineering and construction firm. Similar methods are applicable in most engineering departments. A later article, based on a study of preliminary estimates vs. actual costs, shows the accuracy that can be expected, why errors arise, and lists reliable ratios for a number of kinds of rough estimating.

Table I—Typical Summary Sheet for Preliminary Estimates

	Estimated Cost		
	Material	Labor	Total
A. Yard improvements	$.....	$.....	$.....
B. Buildings including services	.....	.....	.....
C. Process equipment	.....	.....	.....
D. Process piping	.....	.....	.....
E. Electrical installations	.....	.....	.....
F. Service facilities	.....	.....	.....
	$.....	$.....	$.....
G. Contingency (....%)			.....
H. Insurance and taxes (....% of labor)			.....
I. Premium time (....% of labor)			.....
			$.....
J. Field office expense including temporary construction			.....
K. Home office expense including overhead			.....
Total cost not including fee			$.....

items are arranged in three columns, the first being Material Cost. This is considered as including all costs other than prime contractor's labor. In other words, it includes not only the cost of equipment and materials required for a project, but also construction equipment rentals and subcontractors' labor. The second column of the table is prime contractor's labor, while the third column is the sum of the Material and Labor columns.

For preliminary estimates the labor cost of each item is usually obtained from estimates of the material or the total cost, depending upon the nature of the item. For items such as yard improvements and process piping, the total cost (material plus labor) is estimated directly. The split between material and labor is then obtained from estimates of relative (percentage) material and labor costs. These percentages depend on the type of work normally subcontracted. For example, if the prime contractor sublets all piping work, then the material cost listed under item *D* will be substantially identical with the total cost, and the labor cost relatively small. However, if the prime contractor sublets only shop fabrication, but installs the piping work himself—or if he is equipped for shop fabrication also—then the material cost will represent a smaller percentage of the total cost.

For items such as process equipment, the material cost is estimated directly. The labor cost is then estimated as a percentage of material cost.

What Work Includes

In Table I the term Yard Improvements includes demolition, cleanup, and grading; roads and sidewalks; railroad sidings; fencing; and landscaping. As with other items in the overall estimate, of course, the cost for each of the items totaled on the summary sheet will be given in individual detail sheets. In pricing these items for a preliminary estimate, quantities are obtained from the preliminary plot plan, including the number of feet of railroad siding, the square yards of paving, the number of feet of fencing, etc. Unit prices which include both material and labor are applied to the quantity estimates. The split between labor and material is based on percentages which depend on the work normally sublet by the prime contractor.

Building Cost Breakdown

In the case of Buildings Including Services, the detail sheets give the cost for each building. In large buildings, separate figures may be given for plumbing, heating, ventilating, and other building services. For small buildings the detail sheets may give only one figure for the total cost of each building, including services. Lighting is, of course, a building service, but is listed under item *E* in the form of tabulation discussed here. This procedure has the advantage of grouping all electrical work, except that included with service facilities.

It is considered good practice not to include any of the following items under building costs: (1) Process equipment foundations for equipment located in buildings: (2) process equipment supports, including platforms, for equipment located in buildings; (3) process plumbing, such as drains for equipment. This procedure is somewhat arbitrary since, for example, roof trusses and building columns must be heavier to support platforms and equipment, but this increment in cost is normally a small percentage (less than 5 percent) of building cost.

Preliminary estimates for buildings are usually prepared on a unit price basis. The size of the building is approximated from the general arrangement drawings. Unit prices are selected for the type of construction which will probably be used. These prices may be in terms of cubic feet of building content, or square feet of floor area. Usually both unit prices are used so that the figures by one method may be checked against the other.

Building services are usually estimated on a percentage of bare building cost basis, or by estimating the heating, plumbing and other requirements, and applying unit cost data to the quantity estimate. Unit price information is available on the average cost of installing plumbing fixtures, heating equipment, etc.

In the preparation of a preliminary estimate of process equipment, it is often convenient to group the equipment as follows: (1) Raw materials storage and handling equipment; (2) processing equipment; (3) finished product storage and handling equipment; and (4) instruments.

Under raw materials and finished products storage and handling, the materials used in and produced by the process should be listed.

The preliminary equipment list and engineering flow sheet are the sources of information on equipment required for materials under groups (1) and (3). The listed processing equipment of group (2) can conveniently be split into functional groups, for example by unit operations and unit processes. Again, the preliminary engineering flow sheet and equipment list will show the equipment required for each group.

In the detail sheets the breakdown should give the cost of handling each raw material and finished product, the cost of each functional group under (2), and the cost of all equipment foundations and supports, including platforms.

Process Equipment Pricing

Although a complete list of all equipment shown on the preliminary engineering flow sheet is sometimes given on the detail sheets, generally the equipment groups will suffice, using the preliminary equipment list as a back-up sheet. However the estimate may be presented, it is important to price each unit of process equipment. The bulk of such equipment consists of tanks, vessels, pumps, agitators and other standard units for which prices are readily available or can quickly be obtained from vendors. In the case of more specialized equipment, such as thickeners, filters and dryers, it is necessary to call in manufacturers and obtain estimates for both equipment and installation. Considerable care must be exercised to make certain that the cost of accessory equipment and materials, such as insulation,

ducts, chutes, gates, etc., is included.

In a preliminary estimate, it is not customary to give separate estimates for the foundations required for each unit of equipment. An estimate for all of the equipment foundations located in the yard, and all of the foundations situated in each building, is sufficient. Equipment foundation costs may be estimated either as a percentage of the cost of all equipment supported on foundations or by estimating the number of cubic yards of concrete which will be required and applying a unit price to this quantity. Similar considerations apply to equipment supports. The square feet of platform required for equipment access, and the approximate weight of the equipment supported on platform structures, are estimated from preliminary arrangement drawings, and a unit price applied to the platform area. Supports not tied into the platform framing may be estimated separately as a percentage of the cost of equipment requiring individual supports.

Process Piping

This heading is taken to include all raw material, intermediate product, finished product, steam, water, air, sewer and other service piping used in the process. Usually it is the most difficult item to price properly, both in preliminary and in official estimates. The procedure discussed here has, however, given good results.

The process piping may conveniently be grouped similarly to the process equipment as already discussed. Preliminary estimates for raw material storage and handling piping are relatively simple. Pipe sizes are estimated (often by experience rather than by calculation or tables), the piping is sketched out on the plot plan and the arrangement drawings, and the number of feet of each pipe size is tabulated for different piping materials to be used. A unit price covering materials, labor and supports is applied to each pipe size to obtain the total cost of the piping required for storing and handling each raw material. The sum of these costs is, then, the total cost of piping for raw materials storage and handling. The same procedure is used for finished product storage and handling.

For process equipment, the procedure depends on the type of equipment included in each functional group. A group may consist, for example, of relatively large equipment, such as thickeners, vacuum filters or dryers, which is likely to be furnished complete with accessory pumping and other equipment and for which piping is easily visualized. An estimated price for the total cost of all the piping for such a group can often be obtained from manufacturers. Otherwise, a rough sketch of the piping can be made and piping costs estimated as outlined for raw materials piping.

However, there will usually be equipment groups, such as tanks, vessels, pumps, heat exchangers, distillation towers, etc., for which each piece of equipment may be furnished by a different manufacturer, and for which the quantity and arrangement of piping is not easily visualized without considerable study. For these groups, the cost of process piping, including installation, has arbitrarily been estimated at 70 percent of the total installed cost of all equipment to which the piping is connected. In piping connected to agitated tanks, the price of the agitators has been included with the cost of the tank in applying this percentage.

In addition to the degree of breakdown indicated above, it may be desirable to show separate figures for instrument piping and for piping insulation. However, for a preliminary estimate, these items may be estimated as a percentage of the total cost of instruments, and the total cost of piping, respectively.

Table II—Service Facilities Listed in Detail Sheets

Electrical
- Transmission line to site.
- Cost of any changes to substation from which transmission line is run.
- Power generation.

Steam
- Boiler house, including buildings, equipment, piping and other accessories.
- Steam line to site.
- Yard distribution piping.

Water
- Water intake and supply facilities.
- Water storage.
- Water treatment.
- Cooling towers.
- Line to site.
- Yard distribution piping.

Fuel Gas
- Line to site.
- Yard distribution piping.

Fuel Oil
- Fuel oil storage and handling.
- Line to site.
- Yard distribution piping.

Compressed Air
- Air compressors.
- Line to site.
- Yard distribution piping.

Sewers
- Lines from site.
- Yard sewer piping.

Fire Protection
- Water line to site.
- Elevated water storage tank, fire pumps, etc.
- Yard distribution piping.
- Fire fighting equipment.
- Sprinkler installations.
- Other fire protection facilities.

Miscellaneous
- Office furniture and equipment.
- Laboratory furniture and equipment.
- Cafeteria furniture and equipment.
- First aid equipment, etc.

Electrical Installations

Electrical installations consist primarily of lighting and power. The first includes both yard and building lighting. The number of lighting fixtures is estimated from the preliminary plot plans and general arrangement drawings. A unit price, depending on the type of installation desired, is applied to the quantity estimate. Ordinarily, the detail sheets will show separate estimates for each building and for the yard.

In the case of power, the detail sheets should give prices for the following: (1) Substation; (2) feeders; (3) control centers; and (4) wiring. The substation is sized from a preliminary motor list and the lighting requirements. Estimates for a complete substation installation are readily available. Feeders are sized and estimated on a unit price basis. Control centers and power wiring are estimated from the number and horsepower of the motors required by the process, and from the type of wiring installation.

Instrument wiring is sometimes shown separately and estimated as a percentage of the cost of the various types of instruments which will require wiring.

There may be certain equipment in the process which will require interlock and other special wiring circuits. Usually, sufficient time is not available to detail such work. If the estimator knows that a large part of the equipment will be interlocked, higher unit cost figures for power wiring will be used.

A breakdown of service facilities to be used in the detail sheets accompanying Table I is shown in Table II. The detail sheets should give separate costs for as many of these items as apply to a particular plant.

Why Unit Prices

In preliminary estimating, the cost of a service facility such as a boiler house or water treatment equipment usually includes all buildings, piping, equipment, wiring and other accessories. There are two reasons for following this procedure rather than grouping the buildings under item *B* in Table I, with the piping under item *D* and the electrical work under item *E*. In the first place, unit prices are available for a complete service facility installation such as a boiler house or water treatment plant. In the second place, there

is often some question in the early phases of design work whether a particular service facility will be required.

If more detail is desired than the unit price basis offers for boiler and power house installations, separate estimates may be made for the major subdivisions of construction work which enter into the facilities. In the case of air compressor installations, costs can be obtained readily from the manufacturers.

The cost of a transmission line to the site, and the cost of any changes in the substation from which this line is run, can usually be obtained from the utility or other company furnishing power. Steam and other service lines to the site are estimated on a unit price basis. The length of piping can be obtained from the preliminary plot plan.

Other Costs

Contingency—An estimate for contingencies is usually expressed as a given percentage of the total physical cost. Percentages ranging from 7 to 15 percent are common, with 10 percent a general average.

Insurance and Taxes—These items include workmen's compensation, public liability and damage insurance, and Federal old age benefits. The item usually runs from 8 to 10 percent of the total labor cost shown in the second column of Table I. For preliminary estimates, 10 percent is commonly used.

Premium Time — Estimates for premium time are necessary in cases where construction schedules are expected to require overtime. For a 48-hour work week with double pay for all time over 40 hours, the labor payroll will be 16 percent higher than if the 48 hours were paid on a straight time basis. The prime contractor's labor, shown in the second column of Table I, is therefore multiplied by 16 percent to give the premium time estimate. The fact that labor may not be as productive for a 48-hour week as for 40 hours is neglected. The subcontractor's premium time will, of course, appear under material costs in the first column of Table I.

Usually no attempt is made to segregate this item in a preliminary estimate. Instead, if it is probable that subcontractors will employ premium time labor, higher unit price data will be used.

Field Office Expense—The item includes temporary construction which is estimated from the site plan, the preliminary plot plan, and the magnitude of the project. Field office expenses proper are estimated from a preliminary construction schedule giving the approximate man-hours probably required for construction, superintendence, field accounting, etc.

Home Office Expense—In this category are included engineering and drafting payrolls, overhead, and out-of-pocket expenses for supplies, such as blueprints and photostats, and for travel, usually to be obtained by estimating the number of drawings required for the project and applying a unit price. A separate estimate is made for the man-hours of engineering required, while overhead is estimated by applying a given percentage to the salaries and wages for engineering and design.

Formal vs. Informal

Unless design work is already under way while preliminary estimates are in preparation, more formal procedures than those outlined here are seldom justified by the information available. As another article to appear in a forthcoming issue will show, a surprising degree of agreement between preliminary estimates and actual final costs can be attained without the more formal psocedures.

MAGNESIA COST

(*Continued from page 129*)

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up to 300 deg. F., 2 in. up to 400 deg. F., 2½ in. up to 500 deg. F. and 3 in. up to 600 deg. F. Above this temperature the magnesia would char, lose its adhesive binders and its original shape and would increasingly become less efficient. For hot surfaces above 600 deg. F. it becomes necessary to use a high heat resistant insulant directly adjacent to the hot equipment followed by magnesia blocks as an outer layer of the combination insulation.

The heat losses and efficiencies of magnesia block coverings are similar to magnesia pipe coverings, as will be seen from Table XII. The figures given refer to a plain application of magnesia blocks over the hot surface with the joints filled in by 85 percent magnesia cement. The efficiencies listed may be increased by from 3 to 6 percent when a ¼-in. coat of magnesia cement is trowelled on and the entire job is finished with a cover of 8-oz. canvas. For estimating purpose it is close enough to use the figures given for 1½-in. magnesia blocks for a combination of 1-in. block and ½-in. cement application.

Magnesia blocks are sold by the sq. ft. at delivered prices. The prices quoted in Table XIII are subject, at the present time, to a discount of 34 percent for most locations in the United States. The cost of a complete insulation job may be estimated by the addition of the net cost of the magnesia blocks and the figures given in Table XIV, which include hauling, scaffolding, waste, wire, cement and the cost of labor based upon the new wage scale for pipe coverers of $2.75 per hr.

Cost of magnesia block insulations will be increased if the equipment is located out-of-doors and must be protected. A good indoor protection is a finish coat of 40 percent portland cement and 60 percent asbestos finish cement over the ½-in. layer of asbestos insulation cement. For better appearance and longer life it is advisable to insert a layer of 1-in. hexagonal wire netting between the asbestos insulation cement and the finish coat. A good outdoor protection may be had by trowelling a ½-in. layer of an emulsified asphalt asbestos compound over the asbestos insulation cement and inserting a layer of hexagonal wire between the asphaltic top coat and the insulation cement. After the asphaltic top coat has become dry its thickness will have shrunk to ¼ in. A 65 lb. roofing felt is also used for weatherproofing outdoor magnesia insulation and, where the magnesia might be damaged by workmen, sheet metal may be used.

Table XIII—List Prices for Magnesia Blocks

(Basis, dollars per square foot)

Thickness, In.	Price, $	Thickness, In.	Price, $
1/2	0.27	2 1/8	0.64
3/4	0.27	2 1/4	0.68
7/8	0.27	2 3/8	0.72
1	0.30	2 1/2	0.75
1 1/8	0.34	2 5/8	0.79
1 1/4	0.38	2 3/4	0.83
1 3/8	0.42	2 7/8	0.87
1 1/2	0.45	3	0.90
1 5/8	0.49	3 1/4	0.98
1 3/4	0.53	3 1/2	1.05
1 7/8	0.57	4	1.20
2	0.60		

Table XIV—Cost of Installing Magnesia Blocks

(Basis, dollars per square foot)

Thickness, In.*	Installation Height—Below 15 Ft.	15 to 25 Ft.	Above 25 Ft.
1	1.15	1.32	1.52
1 1/2	1.20	1.38	1.66
2	1.25	1.44	1.72

* With additional ⅛ in. cement finish.

EDITORIAL VIEWPOINTS

Sidney D. Kirkpatrick and Staff

WHO SANK S-526?

We were too optimistic last month when in our editorial foreword we referred to the National Science Foundation as "at last a legislative reality." President Truman's veto two years to the day after the first atomic bomb was dropped on Hiroshima came to us with just as much surprise and as little warning. Only a few days before we had been told by S-526's sponsor, Senator Smith, that the bill was expected to have clear sailing at the White House after so many years of debate and discussion.

Now that we have survived our first feelings of disappointment and frustration and have studied the President's sober "Memorandum of Disapproval," we are a little more tolerant with his viewpoint. It is not, as we first surmised, a mere political move to put control of science under governmental bureaucracy, to make places for presidential appointees to do the bidding of politicians in allocating funds for education and research. We suspect that the Bureau of the Budget had a hand in recommending this veto. Certainly its director has long opposed the type of autonomous freedom that the scientists wanted, and to some extent had, under O.S.R.D.

But the really persuasive reasons for the veto probably came from the little group of White House advisors who have been studying the problem of coordinating governmental research. They were quick to see that the autonomous Foundation of part-time consultants would have been powerless to control departmental expenditures or to curtail projects that involve duplication and waste of scientific manpower. They also realized that a bill which in itself carried no immediate appropriations could do little more than drain funds from other agencies. And, finally, they recognized the fact that under present circumstances there is really no lack of money for private as well as governmental research and for almost as many scholarships as the universities can adequately absorb. So these White House advisors apparently had no hesitancy in turning loose the torpedoes that sank S-526.

What now? The next move is probably up to the President's advisors. If so, we can expect some time this fall to see the presidential appointment of a federal coordinating committee with authority to oversee and to some extent control existing programs of governmental research and federal aid to science. Meanwhile, we are told that a successor for the Bush report is being written in the White House. From it may well come a program that will determine the future course of science legislation.

SCIENTISTS LOSE A ROUND

No matter who was responsible for the presidential veto of National Scientific Foundation legislation, that action nevertheless representad a loss of prestige for pure science. It represented also the loss of a round in the long-drawn battle between bureaucrats and academicians. For the bureaucrats certainly won.

There has been too little publicity on a bitter but hidden controversy in Washington. In it the top scientists of the National Academy of Science have been pitted against the career executives of the Government. This controversy developed during the days of O.S.R.D. when governmental scientists were, so they thought, rudely ignored. Some of the Government men even went so far as to charge deliberate sabotage of career programs by some of the academic scientists who came to Washington on war projects. Fortunately, this controversy did not in any significant number of cases actually interfere with patriotic cooperation on war projects. But all is not so quiet on the Potomac now.

The President was strongly advised to veto the Foundation Bill by departmental executives who feared that their control of scientific bureaus would be weakened. They cited evidence that apparently proved quite persuasive. Whether the governmental scientists shared this fear and urged their political chiefs to oppose the Foundation program, is not so clear. But the career executives over the scientific bureaus did make a most successful attack.

It is unfortunate that this issue has arisen but it will not be met or the difficulty eliminated by attempts to evade the underlying problem. If we are ever to have a national science policy it will come only if the career agencies and the Academy of Science leaders find some common meeting ground for recognizing the merit of each group and its proper place in a national program.

IS NITRATE DOOMED?

Ammonium nitrate cannot today move freely either on land or sea under conditions comparable to those which prevailed a few months ago. Water transport has been almost completely interrupted by new rulings intended to prevent repetition of disasters such as those at Texas City and Brest. Means have not yet been found to insure adequate public safety without limitations that practically preclude nitrate movement in most harbors.

Fortunately, there has not yet been any stampede of excessive safety regulations in most areas. The Army can probably continue to move its exports for the areas of Occupation, but the costs will be high, especially where lighterage loading of ships must be substituted for dockside loading.

Where ammonium nitrate still moves, the costs are going up rapidly. This completely unbalances the normal relationships between fertilizer chemicals. It is requiring radical change in both production and marketing programs. The ultimate result may be the manufacture of numerous products containing ammonium nitrate which are definitely not explosive under any conditions. A mixture of ammonium nitrate with dolomite or with ground phosphate rock may be one of the results.

WATER PRIORITIES

SHRINKAGE of water supply in several important industrial areas has been noted here in several recent editorials. One feature of that threat deserves more attention than it is getting. We refer to the fact that industrial water supply must take second place to urban water supply for the general public.

As far as we know there has never been established an official priority list determining who first gets water and who waits. But there is no doubt that industry is not number one. This means that new establishments with large water requirements must not choose plant locations where they are unduly competitive with city water supplies. If they do, they will suffer whenever scarcity threatens.

Perhaps it is equally safe to conclude that industrial water supply is more important than irrigation, navigation, or power production. But there will be debate on those issues wherever competition develops. The smart chemical management will study all of these questions very critically when choice of a new plant site is under consideration.

ROBBING PETER TO PAY PAUL

MORE engineers with masters' or doctors' degrees are needed by industry today than ever before. Young men completing such graduate study in a creditable manner can now choose between several offers for their first employment. The magnitude of the demand is evident from the beginning salaries which often exceed $5,000 for first employment of Ph.D.'s.

Colleges training chemical engineers are well aware of this demand and are encouraging both GI's and civilian war-service men to come back for further college work. This is fortunate and should be a more general practice for the good of the individual and the benefit of industry.

In this situation, however, there is one disturbing factor. It is a tendency to develop numerous graduate courses at the expense of undergraduate training. Most faculty men find greater satisfaction in teaching candidates for graduate degrees. Often there is an increase in remuneration. That is not bad until it reaches the point that undergraduates get seriously inferior teaching. And we are not talking about a theoretical situation in our concern with this latter possibility.

We believe that no school is justified in adding courses for graduate study until it can do so without depriving the undergraduate of proper instruction. We strongly commend the policy which has been so ardently advocated lately at the University of Tennessee. There the effort has been to employ new faculty members competent to do the graduate teaching, or to take over the undergraduate classes of those who have been forced to concentrate on graduate courses. Let us hope that more schools will follow that sound principle.

PAYING FOR POLLUTION

WASTE disposal and related problems of atmospheric and stream pollution are becoming of increasing concern to chemical engineers and executives. Some companies have set up study groups in their research and engineering departments to prepare for the time when corrective measures can no longer be deferred. Others are already in trouble with state and local officials and face the necessity for immediate and continuing expenditures that run into considerable sums. Under these circumstances, it seems appropriate to ask about the accounting for such outlays. Is it not true that they are a definite element in production costs, and should be so charged?

A consulting engineer of wide experience in this field tells us that such costing practices are the exception rather than the rule in most process industries. Waste disposal problems have grown like Topsy, and are likewise of equally uncertain parentage. They have become part of overhead and the general cost of doing business. They seldom have been related directly to the trouble-making products and processes. But our friend insists that we are only fooling ourselves when we refuse to put these costs where they belong, when we penalize other phases of the business by selling certain products at less than their true production costs. Now is a good time to correct such malpractices because waste disposal and pollution problems are certain to prove much more costly in the future.

"READS LIKE A PATENT"

UNDER the Constitution of the United States, Congress is empowered to grant patents for a limited time to inventors "for the purpose of promoting the progress of science and the useful arts." Too often the inventor regards his patent solely as a reward for disclosing his invention. Too seldom does he regard his patent as a technical document in which he is obligated to describe his invention in such a way as to teach its principles to the public.

Speaking last spring to the Executives Conference of the Institute of Paper Chemistry, the able Commissioner of Patents, Casper W. Ooms, made a strong plea for simplification and clarification of patents in their function as contributions to technical literature. He noted how frequently a patent is a document of advocacy rather than exposition. "Technical men," he said, "are impatient with the tendency of the inventor to arrogate to his invention a technological importance which it does not possess." But the common fault that puts the heaviest burden on our patience are the legalistic technicalities of expression that are so often used in drafting a patent. They seem to be designed to confuse rather than inform —to make the simple seem complex and intricate. To find that our own irritation is shared by the distinguished Commissioner of Patents was very comforting, but what can we do about it?

The principal responsibility, as Mr. Ooms pointed out, lies with the patent lawyers who draft the documents. However, to the extent that engineers and executives must pass upon and work with the patent draftsmen, we share in that responsibility. We can and should work for simplification and clarification of patents as contributions to the technical literature. The Patent Office will welcome such efforts on our part. And in our opinion, the patent system itself will be benefited and strengthened by the degree to which patents succeed in disclosing information that will promote progress in science and the useful arts.

THE PLANT NOTEBOOK

Theodore R. Olive, ASSOCIATE EDITOR

$50 CASH PRIZE FOR A GOOD IDEA!

Until further notice the editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. The winner each month will be announced in the issue of the next month: e.g., the September winner will be announced in October, and his article published in November. Judges will be the editors of *Chemical Engineering.* Non-winning articles submitted for this contest will be published if acceptable, in that case being paid for at applicable space rates.

Any reader of *Chemical Engineering,* other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible Neither finished drawings nor polished writing are necessary, since only appropriateness, novelty and usefulness of the ideas presented are considered.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering,* 330 West 42nd St., New York 18, N. Y.

AUGUST WINNER

A $50 prize will be issued to

DUANE E. RICHARDSON

and

FRANK C. ARRANCE

The Electric Auto-Lite Co.
Spark Plug Division
Fostoria, Ohio

For an article describing a machine and method for the periodic cleaning and de-scaling of water-cooled gas burners that has been judged the winner of our August contest.

July Contest Prize Winner

LIQUID PISTON PUMP SIMPLIFIES HANDLING OF CORROSIVE GASES AND LIQUIDS

G. E. HADDELAND
Chemical Engineer, Shawinigan Chemicals Ltd.
Shawinigan Falls, Que.

Shown in the accompanying illustrations is a liquid piston pump designed for the small scale handling of corrosive gases such as moist hydrochloric acid and chlorine, against low pressures. The same principles, however, can easily be extended to larger scale, while a simple modification of the position of the solenoid contacts would readily permit the apparatus to pump liquid hydrochloric acid or other electrically conducting corrosive agents.

Construction, indicated in the drawings, is simple and inexpensive. The principle parts and their approximate costs are: (1) Two solenoids, a.c., intermittent, 1-in. stroke, rated 14 oz. lift and 79 va., at $8; (2) two one-way Pyrex glass stop cocks, at $6; (3) one dash pot or damper, at $2.50; (4) two 1-ft. lengths of 1-in. Pyrex glass pipe, at $11; and (5) one 1-in., 180-deg. Pyrex glass return bend, at $6.50. These items total $35.

As Fig. 1 clearly indicates, three carbon contacts installed in the legs of Pyrex U control the flow of current to the two solenoids, which in turn operate the two Pyrex stop cocks to control the admission and exhaust of air pressure which provides the motive power for the pump. A discussion of the operating cycle will facilitate an understanding of the device.

Low-pressure air applied to the left-hand leg of the Pyrex U forces liquid (hydrochloric acid solution or other conductive liquid suitable for the gas handled) upward into the right-hand side, thus discharging the gas through one of the two check valves, until the liquid closes the circuit with contact a. This causes the right-hand solenoid to operate, turning the stop cocks so as to disconnect the air supply and release the air pressure in the left-hand side. Then the liquid falls back, draw-

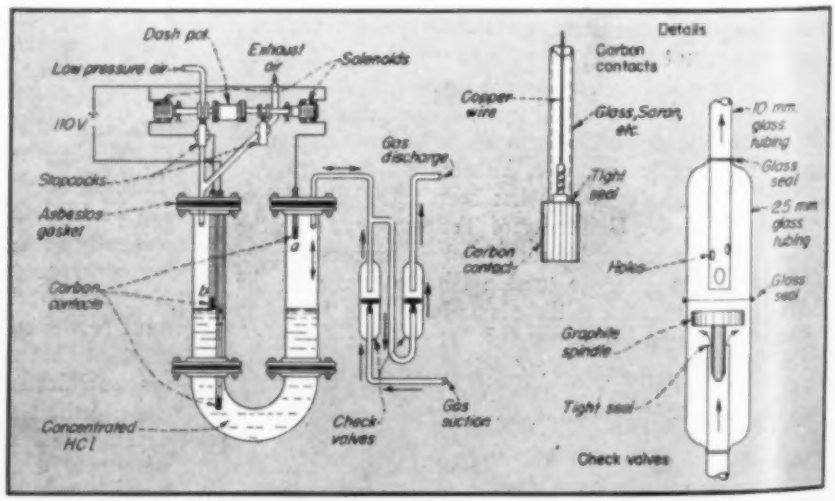

Fig. 1—General arrangement of liquid piston pump for corrosive gases

Fig. 2—Details of carbon contact and Pyrex-graphite check valves

ing more gas in through the second check valve. When the conducting liquid reaches contact *b*, the left-hand solenoid operates to re-connect the air supply and close the exhaust stop cock, so that the discharge repeats.

Features of Pump

The design has both advantages and disadvantages. On the favorable side are the facts that it eliminates packing glands, lubrication and piston wear, while at the same time it gives a semi-automatic control of the rate of pumping, dependent on the rate at which gas becomes available, and on the pressure of the actuating air. On the negative side are the facts that the pump gives a pulsating gas suction and discharge, while it is difficult to obtain good check valves of adequate corrosion resistance.

In the small size of pump shown here a capacity of ½ cu.ft. per minute can be expected. The pump could readily be built to a larger scale and it could be built from other corrosion resistant materials, either metallic or non-metallic, if desired. An improvement would be to employ a multiple cylinder arrangement to smooth out the pulsations.

AVOIDING AIR LEAKAGE IN VACUUM PUMPING

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Engineer, Darling & Co.
Chicago, Ill.

IN PUMPING out a deodorizing system under 28 in. vacuum, several little tricks had to be worked out to make a centrifugal pump successful. The capacity was low in gallons per minute, but the total dynamic head was rather high and stuffing-box trouble developed. Instead of liquid leaking *out*, air leaked *in*. We had some trouble in keeping the pump primed, and more trouble in reading the rotameter.

A single-suction, close-coupled pump of conventional design had been chosen to get one less stuffing-box. The manufacturer had drilled holes through the web of the impeller so that the pressure would be balanced. As we were working at the left-hand end of the pump curve, we did not feel that the holes were required and plugged them so that the stuffing box was under pressure, instead of vacuum.

Since the end thrust becomes rather high when the balancing holes in the impeller are plugged, the idea is applicable only to ball-bearing pumps of standard design, which are intended to operate in any position, even vertical.

In an application of this type a float-controlled valve will ordinarily be used in connection with the pump. Such valves carry an arrow to show intended direction of flow. If the valve is installed in the reverse position, with flow opposing the arrow, the stuffing box will be under reduced vacuum and operation will be improved.

SPRAY PROTECTION FOR CONVEYOR OPENINGS

ACCORDING to a talk presented by Norman J. Thompson at the 1947 convention of the National Fire Protection Association (published in the July *N.F.P.A. Quarterly* and abstracted in *Factory Mutual Record*), extremely interesting results have been achieved in experimental work on the use of water spray nozzles to prevent spread of fire and hot gases through conveyor openings in floors and fire walls. Where continuous materials handling equipment extends through barriers such as walls and floors, it is ordinarily impossible to provide adequate protection by means of fire doors or hatches. Work was therefore instituted at Factory Mutual Laboratories to find methods that would substitute satisfactorily for fire doors in cases where such protection is impractical.

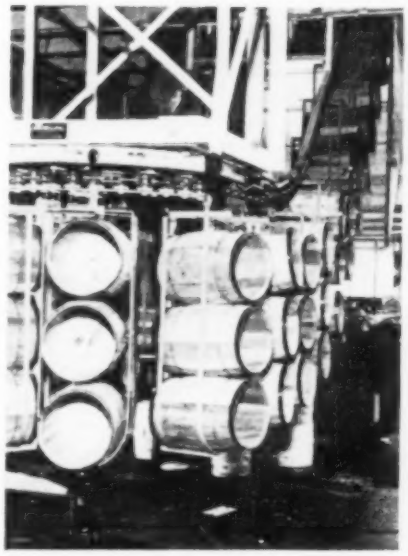


Fig. 1 — Continuous conveyor openings can seldom be closed by fire doors

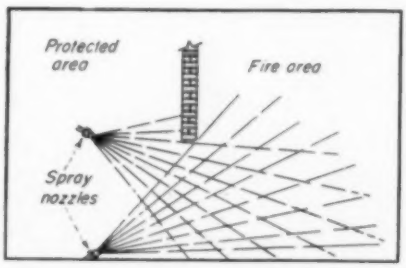


Fig. 2—High velocity sprays prevent passage of heat through openings

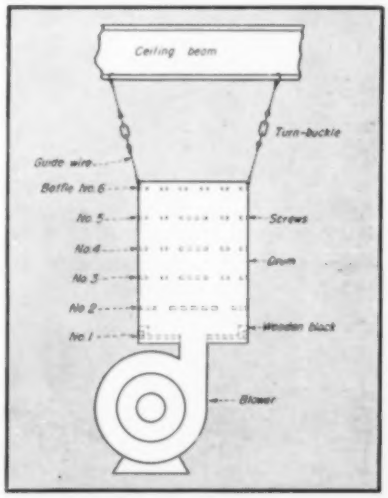
Nozzles Oppose Flame

Further work is necessary, it is stated, before specific installation details can be recommended, but the general methods used so far are still of much interest. Fig. 1 indicates a type of installation for which spray protection is indicated. Fig. 2 shows in the case of a simple wall opening how nozzles discharging against the direction of flame propagation can be used to prevent their spread into a protected area. It has been found that uni-directional, high-velocity type nozzles produce a very considerable air movement. This phenomenon can therefore be used to oppose the flow of hot gases through an opening. The cooling effect of the water spray, of course, provides additional protection. Tests have shown the method suitable for both wall and ceiling openings, with complete prevention of dangerous passage of fire and heat through the openings, even in the cases of extremely hot fires.

MUFFLER SILENCES NOISY LABORATORY EQUIPMENT

WILLIAM E. SHAEFER
National Lead Research Laboratories
Brooklyn, New York

OPERATION of various types of laboratory equipment which require powerful blowers is attended by production of undesirable noise. A laboratory spray dryer is a case in point. When it is operated for long periods, or in a laboratory near offices, classrooms, or dwellings, this noise is highly objectionable. The noise problem has been solved in one instance by



Muffler made from 55-gal. drum and fiberboard baffles

construction of the baffle type muffler herein described. The use of this muffler is not restricted to a laboratory spray dryer. It should function equally well on any noisy exhaust.

The muffler consists of a 55-gal. drum with both ends removed. Inside this drum were inserted six equally spaced disks of ¼-in. thick fiberboard. The first disk contains one center hole large enough to fit over the discharge pipe from the blower. The first baffle disk contains six 3-in. diameter holes, drilled on a circle of such diameter that the discharge air from the blower detours in passing through this baffle. This design was followed in the remaining baffles, so that no two holes are directly above one another in the muffler. The table below shows the number of 3-in. diameter holes and the exposed area in each baffle.

Baffle Number	Number of Holes	Exposed Area, Sq. In.	Area Increase Over Baffle No. 1
1*	0	19.6	0
2	6	42.4	2.2
3	8	56.5	2.9
4	12	84.7	4.3
5	14	98.9	5.0
6	18	127.0	6.5

* Bottom of muffler.

The bottom disk is held in place by four wooden blocks 2 in. × 2 in. × 4 in., attached by screws to the sides of the drum with the disk screwed to these blocks. The five baffles are held in place by 1½-in. long wood screws. The muffler is held in place over the blower by means of four guide wires each fitted with a turn-buckle. The guide wires are attached to the laboratory ceiling beams.

Sound Level Reduced

The intensity of the noise was measured with a General Radio Co. Type 759 sound level meter. All measurements were made at the operator's usual position. Operating the spray dryer without the muffler produced a sound of 94 decibels. The discharge from the blower had a velocity of 3,360 ft. per min. The sound level of the laboratory with no equipment operating was 38 decibels. With the muffler in place over the discharge end of the blower, the sound level was 79 decibels, while the discharge air velocity from the muffler was 242½ ft. per min.

By using a muffler of this design, the discharge air velocity was decreased 3,117½ ft. per min., while the sound level was decreased 15 decibels, a very noticeable improvement.

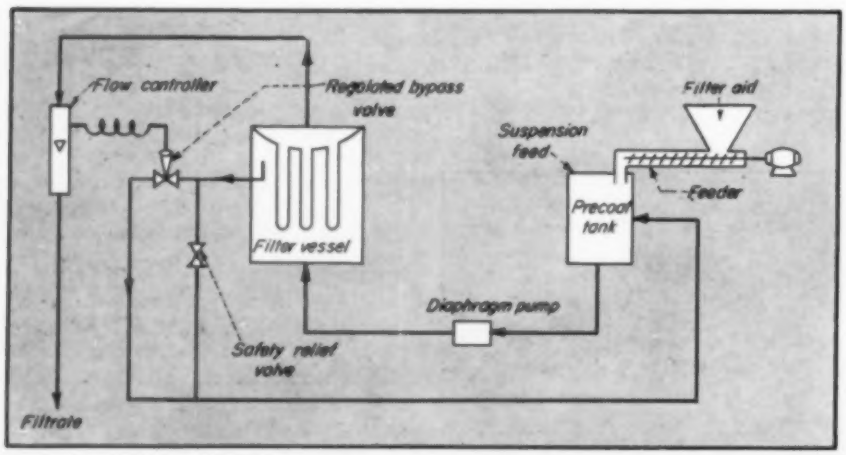
CONSTANT RATE FILTRATION IN LEAF FILTERS

J. F. SCHNACKY
Chemical Engineer
Buflovak Equipment Div., Blaw-Knox Co.
Buffalo, N. Y.

WHEN filtering gelatinous materials, it is desirable to use a leaf precoat with continuous addition of filter aid to the suspension to be filtered. This filter aid addition builds a porous structure around the slime in the filter cake, thus lengthening the filtration cycle. However, a continuous build-up of filter aid on the leaf decreases the retained volume of the filter vessel and thereby the displaced liquid is forced through the filter leaf into the filtrate. This produces a slightly varying filtrate discharge, even though constant feed to the filter is maintained. This variation is undesirable in a delicately balanced, continuous process.

The layout portrayed in the illustration overcomes this variation by means of a flow controller on the filtrate discharge line. This is a bypass valve in a recycle line between the filter body and precoat tank. The advantages of the method are five-fold:

1. A continuous, constant discharge is maintained.
2. The recycle volume gives agitation in the precoat tank which is being continuously fed with filter aid through a screw feeder.
3. The displaced liquid in the filter tank is automatically transferred to the precoat tank throughout the entire cycle.
4. A visual check can be maintained on the stage of filtration by the liquid level in the precoat tank.
5. At the end of the cycle the precoat tank contains the exact volume needed to fill the cleaned and precoated filter vessel, plus a constant tare.



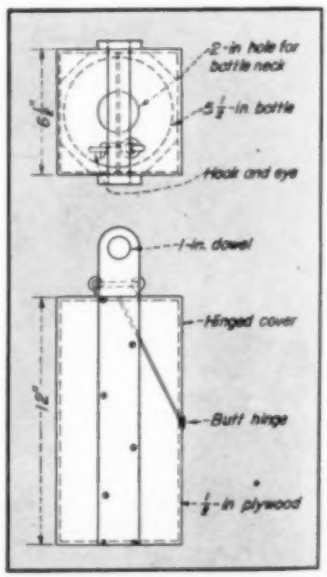
Flow-controlled recycle line improves pre-coat filtration

DURABLE CARRIER MADE FOR ACID BOTTLES

CPL. M. C. ZIEMKE
Oak Ridge, Tenn.

PRACTICALLY self-explanatory, the diagram shown here gives the construction details involved in the fabrication of an all-purpose acid bottle that is easily built in any plant's carpentry shop, having only a minimum of power tools.

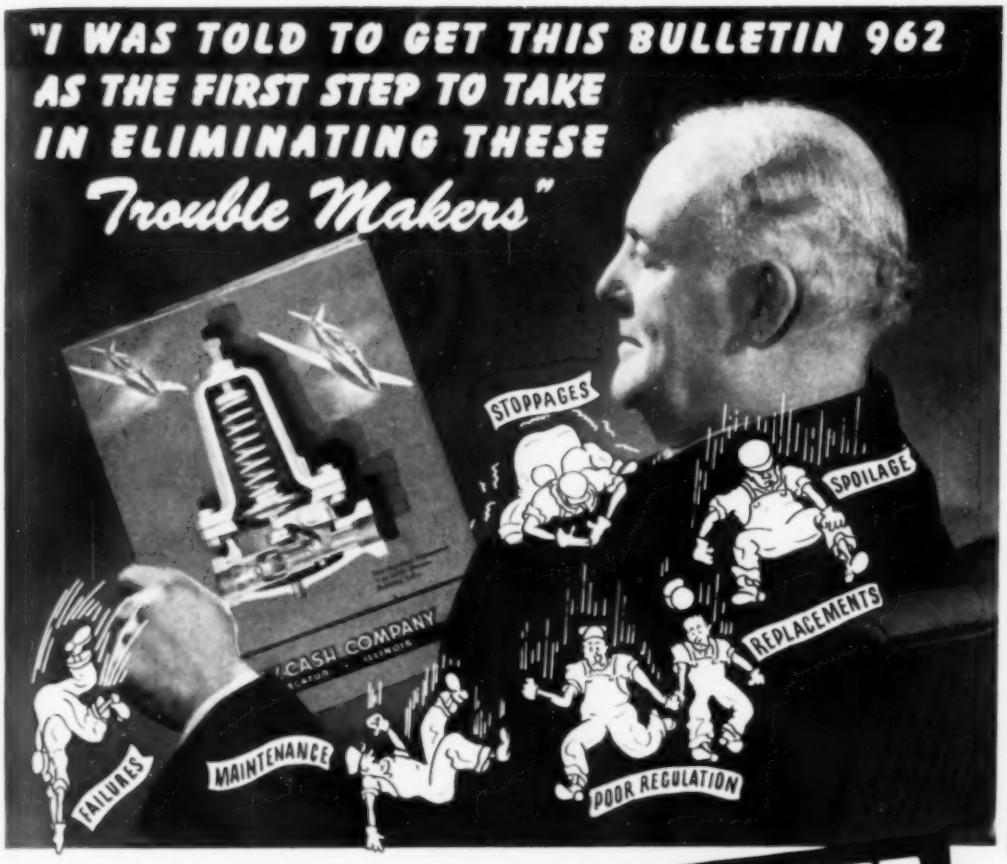
Two coats of spar varnish served to preserve the wood. The identification



Wooden acid bottle carrier easily built in plant shop

was added by burning in the proper lettering with an electrically heated "branding iron." The latter precaution was used to channel the bottles through the proper departments and to avoid using containers for dissimilar acids. The 1-in. dowel handle made carrying effortless, even when the bottle was transported some distance. The square shape provides for easy stacking when hauling by truck or indoor power handling equipment.

"I WAS TOLD TO GET THIS BULLETIN 962 AS THE FIRST STEP TO TAKE IN ELIMINATING THESE *Trouble Makers*"



CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVE

THIS gentleman was given the right tip. The Bulletin 962 is a signal to the "6 pests" to begin traveling far away to new haunts. They just can't cause the headaches they usually do because the CASH STANDARD Streamlined Type 1000 Pressure Reducing Valve stops them cold.

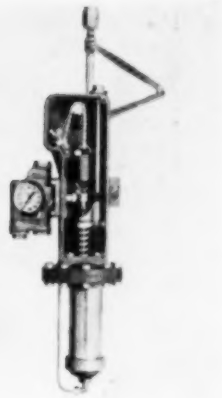
We will be glad to send you a copy of Bulletin 962. We know that the information it contains about the benefits of "Straight Line Flow" will prove very interesting to you.

Maximum Capacity When Needed Most • Accurate Pressure Control Under Toughest Working Conditions Trouble-Free Service • Smooth Operation • Tight Closure • Accurate Regulation • Speedier Production Results • Elimination of Failures • Constant Delivery Pressure • Cost Saving Operation • No Spoilage • Practically Zero in Maintenance Costs

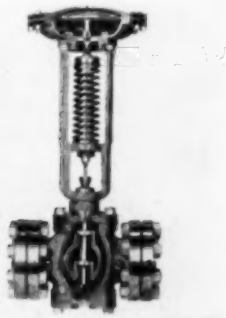
CASH STANDARD CONTROLS . . . VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

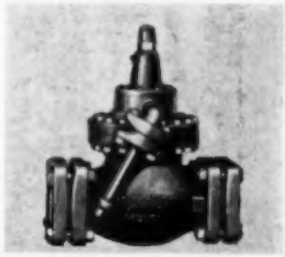
• **BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES** *Send for them* •



Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.

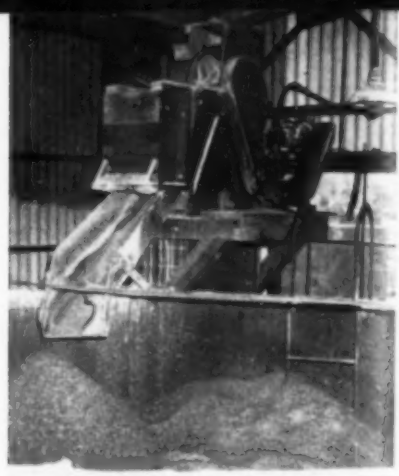


Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.



Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

Here G. E. produces phenol for its plastic operations at Pittsfield, Mass. Brine building at left, still building in center, background reactors at right



1 Salt is elevated to hopper for preparation of brine for cells

PHENOL

A PLANT for the production of synthetic phenol from monochlorbenzol by a continuous process has been put into operation by the Chemical Department of the General Electric Co. at Pittsfield, Mass.

The plant makes its own chlorine and caustic in Hooker Type S cells. The cell feed is made from rock salt which is converted into a brine and purified. Chlorine is used for chlorinating the benzol, and caustic soda for hydrolyzing the monochlorbenzol.

Caustic effluent from the cells is evaporated to 20 percent and the salt crystals separated. Caustic is then diluted to 10 percent and held for use in hydrolyzing the monochlorbenzol. Chlorine leaving the cells at 180 deg. F. is passed through a heat exchanger cooling it to 55 deg. The gas is next dried and compressed to 20 lb. and goes directly to the chlorinator. Here it comes into contact with benzol and monochlorbenzol is formed. Gases leave from the top of the chlorinator. The hydrochloric acid is removed for use in neutralizing sodium phenolate in the formation of phenol. The liquid leaving the chlorinator is composed of unreacted benzol, monochlorbenzol and dichlorbenzols. It is neutralized and then the components are separated. The monochlorbenzol, caustic and diphenyl ether are mixed in the emulsifying tank. The mixture is compressed to 4,000 lb. per sq. in. The temperature of the mixture is raised to 500 deg. F. in a heat exchanger. It then goes to the reactor. The feed first enters the radiant section of the tubular reactor and the temperature is brought up to reaction temperature. In the conversion section the reaction mixture is held at the high temperature until the reaction is complete. Substantially all monochlor is reacted to sodium phenolate, diphenyl ether or high boiling residues. The mixture is cooled and the pressure reduced. In a decantor the diphenyl ether is separated. Phenolate is neutralized with hydrochloric acid forming brine and phenol. There are two layers formed, a brine layer and a phenol-water layer. The phenol in the layers is recovered by distillation and sent to storage from which it is shipped in tank cars to the resin plant of the company a few miles distant.

CHEMICAL ENGINEERING

September, 1947

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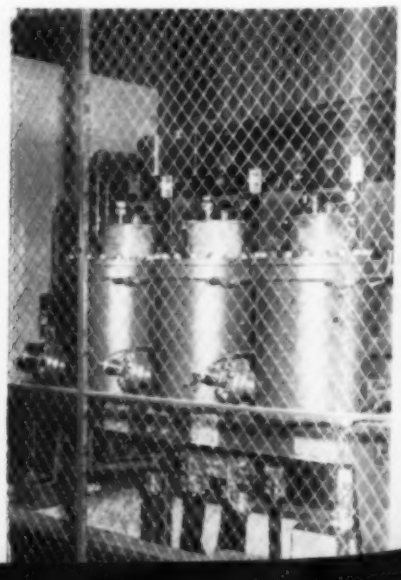
2 Warm saturated brine goes directly to electrolytic cells. Chlorine leaves cells at a temperature of 180 deg. F.

3 Two rectifiers, one of them shown, provides d.c. current for cells



PROCESS EQUIPMENT NEWS

Theodore R. Olive, ASSOCIATE EDITOR

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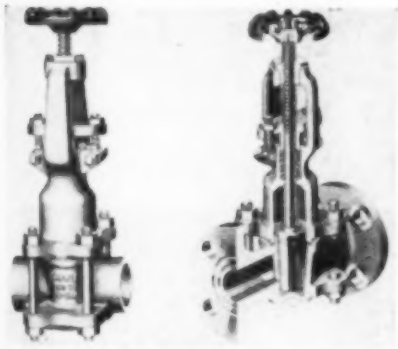
1. Stainless Spargers

A NEW LINE of industrial gas dispersion units for pipe connections in sizes from ⅛ to ½ in., and with porous element diameters from 1 to 3½ in., has been introduced by Micro Metallic Corp., 193 Bradford St., Brooklyn 7, N. Y. These units consist of a disk of porous stainless steel welded at its periphery to a shallow stainless steel dish, which in turn is welded to a standard female pipe connection. The desired gas dispersion capacity can be secured by attaching the necessary number of spargers to a pipe manifold installed in the bottom of the tank. The porous elements are available in various pore sizes ranging from 5 to 65 microns. Despite the production of very fine gas bubbles, flow capacity for all grades is said to be high, with low pressure drop. If desired, special sizes and shapes can be supplied.

2. Plug Gate Valves



Plug gate valve with screwed or flanged ends

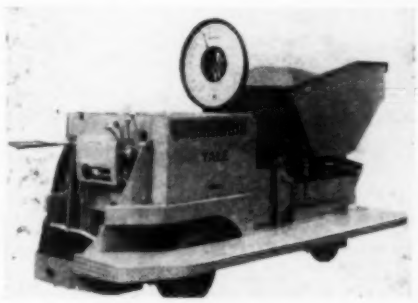
A NEW LINE of corrosion-resistant plug-gate valves, unique in combining the advantages of two important basic types of valves, has been announced by Crane Co., 836 South Michigan Ave., Chicago 5, Ill. The new design provides straight through flow in the wide-open position, as do conventional gate valves, but is suitable for throttling service, similar to conventional globe valves.

Extensive tests of the valve, both in the laboratory and in the field, are said to have proven conclusively that the valve gives extra long life under extremely severe conditions, that it offers very little resistance to flow in the wide open position, and that it permits close throttling at both high and low velocities. Furthermore, the valve is claimed to be proof against sticking of the plug in the closed position, even when it is seated when hot and opened when cold.

As the illustration shows, the valve employs a rising tapered plug and is of outside-stem-and-yoke construction to remove operating threads from contact with the fluid handled. For extra safety, the bonnet is provided with four bolts rather than two, while a deep stuffing box is provided. These valves are produced regularly in sizes from ½ to 2 in., with either screwed or flanged ends, in 18-8 Mo, or Monel metal. Other alloys can also be secured to customer's specifications.

FOR MORE INFORMATION
See Reader Service
Coupon on pages 163-164

3. Batching Truck



Scale and hopper truck for batching

THREE DIFFERENT materials handling tools have been combined in a single mobile unit in the case of a new portable batching scale and dump combination truck introduced by Yale & Towne Mfg. Co., Philadelphia Division, Philadelphia, Pa. The unit combines a shock-absorbing dump bucket, a platform scale, and a standard electric load-carrier truck. The dump hopper, of 40-cu.ft. capacity, is supported on the platform of the scale by means of four heavy coil springs. The scale itself is graduated in 5-lb. graduations and records loads weighing up to 3,000 lb. The electric truck is said to have been designed for great power, simpler control, speed and maneuverability.

4. Chemical Crusher

A NEW Bradmill crusher developed especially for reducing a variety of chemical solids including phenolic plastics to roughly cubicle particles, has been brought out by Pennsylvania Crusher Co., Liberty Trust Bldg., Philadelphia 7, Pa. The crusher is simple in design, combining the impact crushing principle with a screening action. All of the output goes through the desired screen size. The two main elements include a rotating screen and a centrally located rotor carrying impact paddles. The main shaft carries the screen which is slowly rotated. The exterior is covered by screen cloth

or perforated plates. Within the screen is mounted a series of baffles against which the material is thrown by the action of the rotor mounted on a secondary shaft. The main shaft is driven by a chain from a motor reducer, while the rotor shaft is mounted within the hollow-drilled main shaft and is driven by a V-belt from a separate motor.

The crusher is claimed to deliver a minimum of extreme fines and to emphasize a cube-shaped product with a minimum of flats and slabs. Capacities range from 300 to 2,500 lb. per hr., depending on material and desired reduction.

5. Mercury Cell

A MERCURY CELL for the production of caustic soda and chlorine, which is stationary rather than of the rocking type, has been introduced by Mathieson Alkali Works, 60 East 42nd St., New York 17, N. Y. The new cell produces 50 percent caustic soda liquor directly from the cell—a much more concentrated solution than is ordinarily obtained. After some 17 years of development, including 9 years of operation of a small commercial installation at Mathieson's Niagara Falls plant, the cell is ready for licensing arrangements on a royalty basis. Licenses are available to companies in foreign countries, and under certain conditions to companies in the United States.

The cell is said to produce caustic soda of high purity such as that required for rayon manufacture, yet to operate successfully in the presence of calcium sulphate in the brine. It consists of two chambers, an electrolyzer and a decomposer, between which is a pump for moving the sodium amalgam from the electrolyzer to the decomposer. In the former brine contacts a mercury cathode and a graphite anode. Direct current passed through the electrolyzer forms sodium amalgam at the cathode and chlorine gas at the anode. The amalgam is then pumped to the decomposer, where it flows downward through a tower containing graphite packing, against an upward current of water which reacts with the amalgam to form 50 percent caustic soda solution and hydrogen gas, thus regenerating the mercury. The mercury, practically freed of sodium, recirculates to the electrolyzer.

Various special features are claimed for the cell. The anode has a flexible connection which permits it to be raised or lowered, thus allowing the anode-to-cathode distance to be adjusted frequently to the most economical space without interrupting current flow. The chlorine released at the bottom of the anode escapes through slots in the graphite, thus permitting the chlorine to pass rapidly to the upper surface of the anodes. The design of the decomposing tower, filled with graphite packings, provides a very short anode-to-anode distance, making for efficient decomposition. The electrolyzer is composed of a standard steel channel and rubber-covered steel side angles, bolted together to form a trough, a construction said to be more economical than that used for other mercury cells.

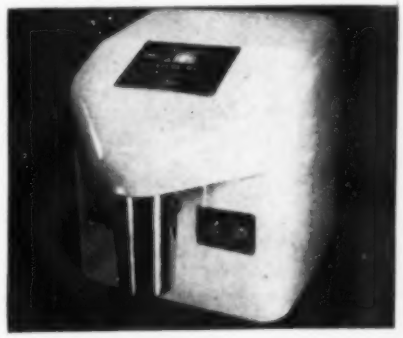
The new cell is claimed to require only 60 percent of floor space needed for horizontal cells, while it is cheaper than the European vertical cells which require less floor space. It is also said to be less expensive to operate. Current consumption is said to be about 15 percent less at equal current densities. Employing a current density of 2.5 amp. per sq.in., a current efficiency of 95 percent is credited.

6. Electric Impact Tool

Impact tool in motor maintenance

ONE OF THE most versatile electric tools ever developed for maintenance and other purposes is the Size 4 U Electric Impact Tool recently announced by Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y. Using a variety of standard attachments, the same tool is able to apply and remove nuts, drill, ream, tap, drive and remove screws, drive and remove studs, extract broken cap screws and studs, run wire brushes, operate hole saws, drill brick and masonry, and drive wood augers. Weighing only 6¼ lb., the tool is provided with an automatic rotary impact device between the motor and the load, delivering 1,900 impacts per min. Since the tool is driven only through impacts, rather than by direct connection with the motor, it automatically assumes the best speed for the type of application; for example, turning a wood auger slowly, turning a tap at an intermediate speed, or operating a metal drill at high speed. The impact action readily frees rusted nuts and studs and, conversely, can be used to apply the desired amount of tension in a bolt on which a nut is run up.

7. Moisture Meter



Electronic moisture meter

BASED on an electronic circuit, a direct-reading moisture meter has been developed by the C. J. Patterson Co., 39-47 Broadway, Kansas City, Mo. The instrument is said to be applicable to moisture measurements with any type of solid, granular or powdered material. It is automatic in operation and requires no calibration curves or charts. Corrections for temperature are normally compensated automatically and a moisture reading can be made in 15 sec. The range is said to be sufficient to meet the requirements for most industrial materials. It is claimed that large changes in line voltage and room temperature do not affect the instrument's accuracy.

8. Tablet Bottling Machine

Automatic tablet bottling machine

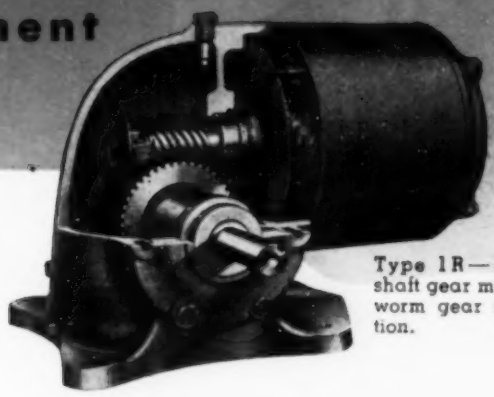
MODEL TM is the designation of a new automatic tablet bottling machine designed to handle a wide range of tablet and bottle sizes that has been announced by the U. S. Auto-

CENTURY
Fractional Horsepower
GEAR MOTORS

Are Engineered to Maintain the High Torque Slow Speed Shaft in Rigid Alignment

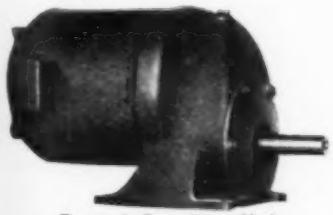
Type 1 P—Parallel Shaft Gear Motor, one step speed reduction.

Type 1 R—Right angle shaft gear motor, one step worm gear speed reduction.



Type 1 R—Right angle shaft gear motor, one step worm gear speed reduction.

Type 2 R—Right angle shaft gear motor, two step speed reduction—one step helical gear, one step worm gear.



Type 1 P—Parallel shaft gear motor, one step helical gear reduction.

Type 2 P—Parallel shaft gear motor, two step helical gear reduction.

The mounting feet of Century Gear Motors are an integral part of the rugged compact gear housing—provides a strong, rigid unit. Additional mechanical strength is achieved by locating the shaft close to the base of the gear housing. This method of construction holds the high torque slow speed shaft in rigid alignment, and reduces stresses.

The motor is equipped with ball bearings. Large taper roller bearings in the gear unit handle heavy radial or thrust loads.

Century Gear Motors are built in standard sizes from 1/8 to 3/4 horsepower — single phase, polyphase and direct current.

Century's line of fractional horsepower gear motors has gained an enviable reputation for outstanding performance. Many thousands of them have been put into service since their introduction eight years ago.

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Your friends in the chemical industry are already on the move to the Texas Coast Country. New plants completed or building in the Houston industrial area bear some of the biggest names in U. S. chemistry.

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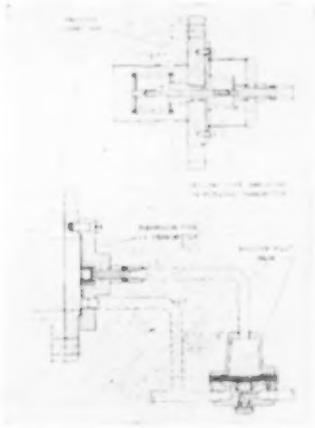
GEO. A. HILL, JR., President

Wholesalers of **Natural GAS**

* *From a letter by Stephen F. Austin, father of Texas.*

matic Box Machinery Co., 18 Arboretum Road, Roslindale, Boston 31, Mass. The machine automatically counts a predetermined number of tablets into the bottle, quickly and accurately, according to the manufacturer. It has been arranged to handle bottles from 1 to 2¼ in. in diameter and up to 5 in. in height. All that the operator has to do is to load empty bottles on to a segmented feeding table. From that point, all operations are automatic. As the bottles reach the filling station, tablets are fed from the hopper on top of the machine down individual chutes equipped with specially designed segmented wheels that count the proper number of tablets into each bottle. Counts can be set in all quantities from 12 to 300. Production rates up to 120 filled bottles per minute are possible. The machine has been designed for ready changeover to other counts and bottle sizes.

9. Pressure Transmitter



Bellows and diaphragm type pneumatic transmitters

ADDITION of amplifying and reducing models to its line of Nullmatic pressure transmitters for liquid level and pressure applications has been announced by Moore Products Co., H & Lycoming Sts., Philadelphia 24, Pa. The new bellows-type instruments are designed to measure process pressures in ranges as small as 1 psi. or as large as 200 psi., and to transmit a range of air pressures to suit standard pneumatic receivers. Also available are diaphragm-type instruments to measure process pressures up to 60 psi. and transmit air pressures at a 1 to 1 ratio. The instruments employ a pneumatic "null" balance principle with a booster pilot maintaining a constant differential pressure across the pilot nozzle in the transmitter, balancing the bellows or diaphragm at essentially a "null" position for all values of the process pressure. The instruments are said to give high-speed linear trans-

PARASEPTS®

Neutral Esters of Parahydroxybenzoic Acid

Preservatives. For products containing gums, mucilages, glue, carbohydrates, fats and oils, and other products subject to deterioration through mold growth, fungus formation, or yeast and bacterial action.

Under certain conditions Parasepts can be used to provide antiseptic properties in lotions, creams, and powders.

Write to us for information on the application of Parasepts to your field of manufacture.

PARASEPTS AVAILABLE:

Methyl Parasept
(Methylparaben U.S.P. XIII)

Propyl Parasept
(Propylparaben U.S.P. XIII)

Ethyl Parasept
Butyl Parasept
Benzyl Parasept

SUPPLIED: 5-lb. cartons; 25-lb. and 100-lb. fiber drums.

HEYDEN CHEMICAL CORPORATION
393 Seventh Ave., — New York 1, N. Y.
CHICAGO OFFICE, 20 North Wacker Drive
PHILADELPHIA OFFICE, 1700 Walnut Street

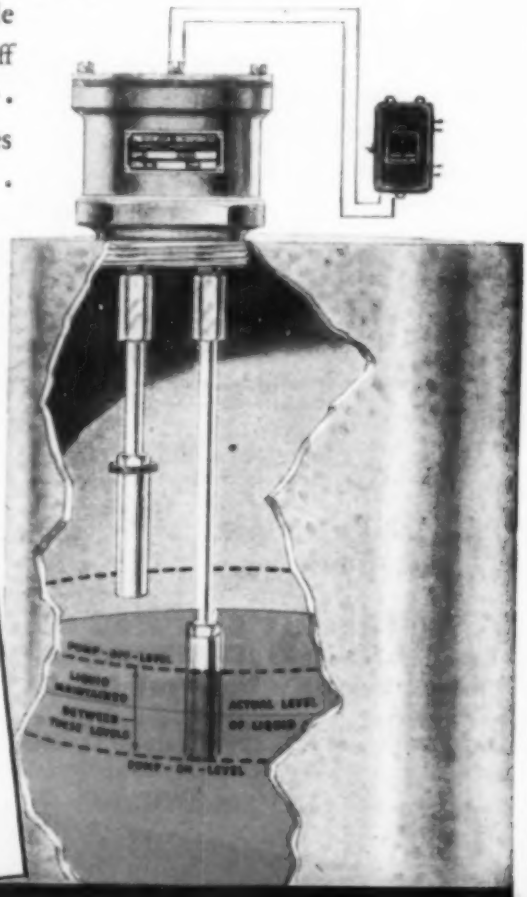
NEW PHOTOSWITCH LEVEL CONTROL

Type 10CB1 Level Control outperforms all other level controls. It accurately maintains *predetermined* levels for liquids or powders. Extensively used for control of water, milk, beer, acids, caustics and most other chemicals in Chemical Process, Food and Sewage fields when the ultimate in control is desired. Special fittings for sanitary installations meet all health board requirements.

The unique principle of Photoswitch design permits contact with liquid under control only by stainless steel probe rods. No floats or other moving parts required. Accuracy independent of temperature and pressure. Low voltage A.C. in probe circuit prevents electrolytic action. Yet amplification through power circuit gives positive control of signals, valves or pumps.

Use Type 10CB1 for single level indication • on-and-off pumping • boiler feed water • boiler condensate • all types of pump programming • The most generally adaptable level control available.

Send for bulletin #201P.



MAINTENANCE—FREE

- NO MOVING PARTS
- NO FLOATS
- NO STUFFING BOXES
- NO BELLOWS SEALS
- NO VACUUM TUBES
- NO MAINTENANCE

PHOTOSWITCH
INCORPORATED
Photoelectric & Electronic Controls for Every Industrial Purpose
77 BROADWAY CAMBRIDGE 42, MASS.

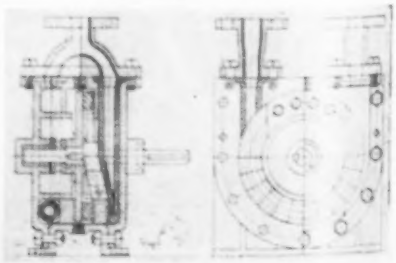
mission and to have high overload protection. A variety of corrosion-resisting materials is available for parts in contact with the process fluids.

10. Flexible Cooling Tower

Standardized natural draft cooling tower

DESIGNATED as Series 200, a new spray type natural draft cooling tower designed for maximum flexibility is being offered by the Marley Co., Kansas City 15, Kan. The tower may be purchased in various sizes and added to at any time as expansion is required. It is suitable for open or closed cooling systems and incorporates several new features developed during extensive field tests. Designed in standard bays to permit increase in tower size as requirements increase, the tower is standardized for volume production and economical construction. It employs rough lumber, utilizing full dimension strength at low cost. Built of selected heartwood lumber and constructed with galvanized bolts and special hardware at critical points, it is designed to withstand a wind velocity of 100 mph. but can be constructed for still higher velocities or for resistance to earthquakes. Capacities range from 65 to 1,580 gpm. or more. Towers are prefabricated and shipped knocked down, with every piece marked for ready erection.

11. Novel Pumps



Improved Huber Squeegee pump

FOLLOWING wartime curtailment of the manufacture of Huber Squeegee pumps (previously described in these pages), manufacture has been resumed

this grocer's floor had become a skating rink

...BUT EMPLOYERS MUTUALS SAFETY ENGINEERING MADE IT SAFE AGAIN

Pride of a super grocery was its beautiful tile floor. But through years of cleaning, a greasy substance had accumulated in the joints—and more and more customers slipped and complained.

It became a question of solving the problem or installing a new floor. Many attempts at a solution had failed. Employers Mutuals safety engineers suggested a raised abrasive strip in the joints of the tiles. The result: the floor was saved, the slipping was stopped, the customers' complaints ceased.

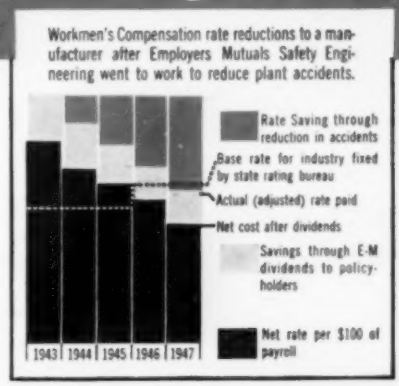
* * *

It is in such cases that the real spirit of Employers Mutuals as a service organization, rather than just an insurance selling organization, becomes vital to you. For Employers Mutuals provide specially trained people skilled in safety work—in accident and fire prevention, industrial safety and health education programs—in prompt claim payment, and in other services.

Employers Mutuals are mutual companies, organized, operated and managed for the welfare of its owners—the policyholders. Therefore they furnish all services that help to reduce your insurance costs and at the same time pay back to you—its owners—all savings beyond ample legal reserves, in the form of dividends. All policies are nonassessable.

* * *

It is the way—the human way—in which Employers Mutuals company-trained men analyze your casualty and liability insurance problems, write your policies, study your operations, and pay your claims, that result in lower insurance costs and return to you part of the premium you have paid.


Workmen's Compensation rate reductions to a manufacturer after Employers Mutuals Safety Engineering went to work to reduce plant accidents.
Rate Saving through reduction in accidents
Base rate for industry fixed by state rating bureau
Actual (adjusted) rate paid
Net cost after dividends
Savings through E-M dividends to policyholders
Net rate per $100 of payroll
1943
1944
1945
1946
1947

A new booklet, "How to Use Employers Mutuals Safety Engineering to Cut Insurance Costs," explains this vital service and its importance to you in reducing your insurance and operating costs. Get a copy from the Employers Mutuals man. Or write direct to the home office for it.

Write on your business letterhead, and ask also for a copy of "A Dictionary of Insurance Terms," a copyrighted book which you can secure only from Employers Mutuals of Wausau.

EMPLOYERS MUTUALS OF WAUSAU

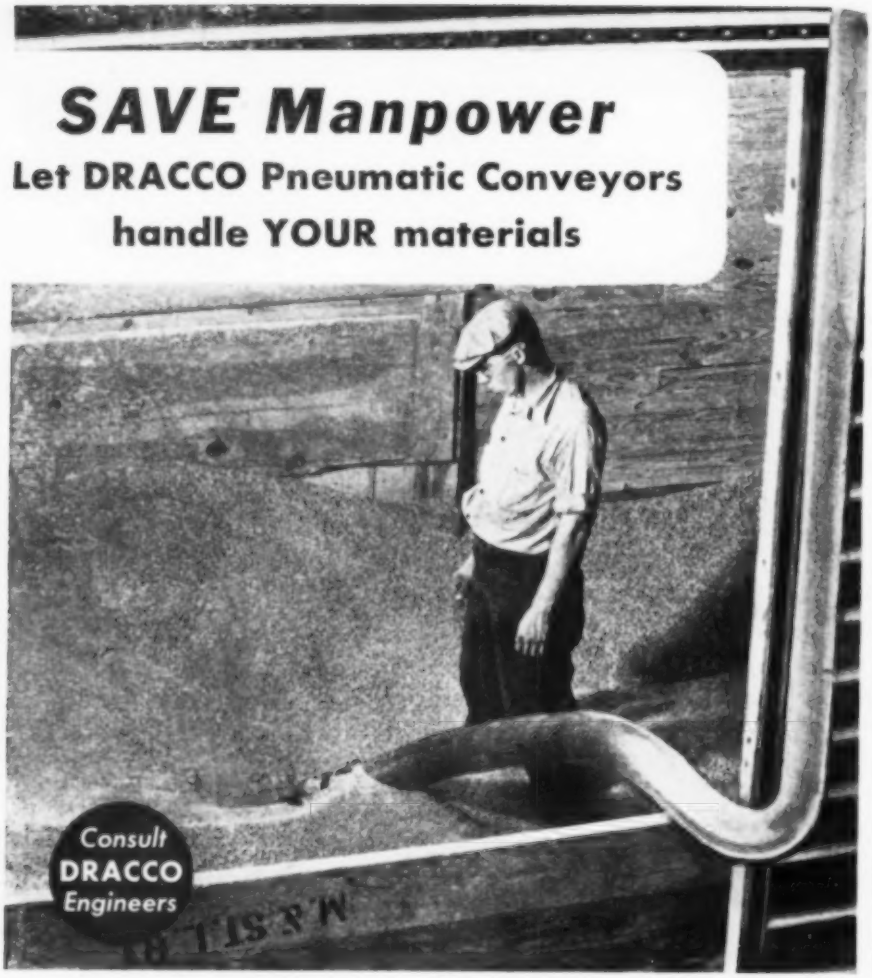
...make insurance understandable

EMPLOYERS MUTUALS OF WAUSAU

EMPLOYERS MUTUAL LIABILITY INSURANCE COMPANY OF WISCONSIN
EMPLOYERS MUTUAL FIRE INSURANCE COMPANY
HOME OFFICE: WAUSAU, WISCONSIN
Offices in Principal Cities—Consult Your Telephone Directory

SAVE Manpower

Let DRACCO Pneumatic Conveyors handle YOUR materials



• Constantly rising payrolls make the use of DRACCO Pneumatic Conveyors more profitable now than at any time in the past. They are used for handling chemicals, grains and granular materials from receiving point to storage or point of use. They save manpower and greatly reduce handling costs. Perhaps it would be good business to check your handling methods — DRACCO Engineers have over 30 years experience and have reduced costs to the minimum for many. Why not consult them?

For Further Information Write

DRACCO CORPORATION

4071 E. 116th St., Cleveland 5, Ohio New York Office 130 W. 42nd St.

DUST CONTROL EQUIPMENT
PNEUMATIC CONVEYORS • METAL FABRICATION

FOR MORE INFORMATION
See Reader Service Coupon on pages 163-164

by a new organization, the Baltimore Pump & Equipment Corp., 1913 St. Paul St., Baltimore 18, Md. This company has introduced an improved version of the original Squeegee pump and also a new pump known as the Huber Cyl-O-Phragm pump.

The improved Squeegee pump, shown in accompanying illustration, employs two U-shaped flexible tubes made of rubber or other flexible compounds. The liquid being pumped passes through the tubes which are progressively compressed from the intake side to the discharge side by means of cams mounted on a driven shaft which moves the compression blocks shown in the drawing against the tubes, closing the tubes gradually and firmly from block to block, and forcing liquid out at the discharge side. No intake or discharge valves are needed. Tubes are completely incased and cannot expand beyond their original diameter. The two tubes operate in parallel, but 180 deg. out of phase with respect to each other, so that their discharge cycles overlap and minimize pulsation.

The Cyl-O-Phragm pump is a novel diaphragm type in which flexible sleeves surrounding two opposed liquid cylinders are alternately expanded and contracted by the pressure of an operating liquid within the sleeves, due to rotation of a cam which reciprocates a pair of pistons in the two cylinders. The sleeves are supported within the cylinders at their ends so as to form an annular space outside the sleeves, sealed from the operating liquid within the sleeves. The space outside the sleeves is the pumping side and is provided with conventional intake and discharge valves.

The Squeegee pump is available for capacities up to 15 g.p.m., for a vacuum of 25 in., or pressure up to 50 psi. The Cyl-O-Phragm pump is suitable for capacities from 20 to 100 g.p.m., against pressures to 100 psi. Neither types requires any packing of moving parts against the liquid being pumped.

12. Sludge Remover

SLUDGE TANKS which are self-cleaning have been introduced in two sizes, one of 400 gal., and the other of 3,200 gal., by Hapman Conveyors, Inc., Detroit 21, Mich. The tanks are provided with baffles to prevent short-circuiting

Penn-Drake

Highest Quality

penn drake
petroleum products

PETROLEUM PRODUCTS

WHITE OILS Penn-Drake offers a complete line of highest quality U.S.P. White Oils ("Drakeols"), and in addition, a series of technical grade White Oils. All grades are refined to exact specifications. They are free from acids, alkalies and other impurities; they conform exactly to specifications and retain their desirable qualities.

PETROLATUMS PENN-DRAKE Petrolatum offers a wide selection of standard grades and colors, as well as specially developed grades to meet special requirements. Made from the finest grades of Pennsylvania crude oil, PENN-DRAKE PETROLATUM is pure, resists oxidation, light and heat; is odorless and tasteless.

SULFONATES Penn-Drake PETROSULS consist of a series of fully refined petroleum sulfonates. For use where surface-active agents are required or desirable. Two types are offered:

PETROSUL 745 SERIES—a low molecular weight, oil-soluble, "mahogany soap", readily soluble in cold water, forming a clear solution.

PETROSUL C SERIES—high molecular weight petroleum sulfonates in either aqueous or petroleum oil concentration.

SOLVENTS Penn-Drake solvents include INSECTI-SOL, a deodorized, 100% volatile, long-floating, non-staining base for insecticides; SUPER-SOL for moth-sprays, odorless paints, home dry cleaners, metal parts cleaners and other uses. Special solvents made for Rubber and other applications and specifications.

NAPHTHAS VM&P Naphthas, dry cleaning and other naphthas as specified. Included also are kerosene, gasoline and similar products.

PENNSYLVANIA REFINING COMPANY

BUTLER, PA.

REFINERIES: KARNS CITY AND TITUSVILLE, PA.

Representatives and Stocks in Principal Cities

Production Smooth and Uninterrupted

WITH ATLAS CHEMICAL PROCESS EQUIPMENT

There is an Atlas product to protect your production against the dangers of "down time" due to corrosion. Processing equipment built to rigid ATLAS specification from ATLAS acid-proof materials is your assurance of maximum efficiency with least maintenance. This has been demonstrated in the past, and is true today in many of the nation's leading plants producing everything from food and beverages to chemicals and steel.

ATLAS materials are built to meet successfully specific situations involving acids, alkalis, solvents and other corrosive substances. ATLAS equipment is not merely resistant . . . it's *impervious* to the corrosive condition for which it was designed.

In addition, ATLAS equipment withstands high working temperatures—withstands fats, oils, greases, water and live steam.

In your plant, you can depend upon ATLAS chemical process floors, tanks, towers, fume ducts, trenches, sewers, neutralizers, etc. . . . and ATLAS cements, plastic linings, jointing materials and protective coatings to help maintain steady production.

Write our Mertztown Office for Bulletin No. T.B-9 . . . and call the ATLAS representative at our nearest branch.

Acid-proof stack lined with brick joined with Atlas VITREX. VITREX is impervious to temperatures up to 1600 F., and regardless of acid concentrations find wide use in acid towers, fume ducts, stacks, acid evaporators and tanks.

Battery of 87 concrete tanks, each 7' x 4' x 9' deep, lined with Atlastiseal and brick joined with KOREZ. These are electrolytic tanks handling 20% H_2SO_4 and 20% $CuSO_4$ at 180° F.

Floor of Atlas acid-proof brick in a dye and pigment factory. Floors joined with Atlas ALKOR (the original acid- and *alkali*-proof cement), take temperatures up to 360° F.

Atlas Engineers are ready to study your flooring problem, to make recommendations and submit plans and estimates—all without obligation.

THE Atlas Mineral PRODUCTS COMPANY OF PENNA.

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PHILADELPHIA, Pa., 355 Fairview Rd. Springfield, Pa.
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THE ATLAS MINERAL PRODUCTS CO. OF TEXAS, INC. Box 252, Houston 1, Texas

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*KANSAS CITY 2, Kan., 1913 Tauromee Ave.
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*SAN FRANCISCO 3, Calif., 244 Ninth St.
*SEATTLE 4, Wash., 1252 First Avenue, S.

*Stock carried at these points

IN CANADA: Atlas Products are manufactured by H. L. BLACHFORD, Limited, 977 Aqueduct Street, Montreal, P. Q., 86 Bloor St. W., Toronto, Ont.

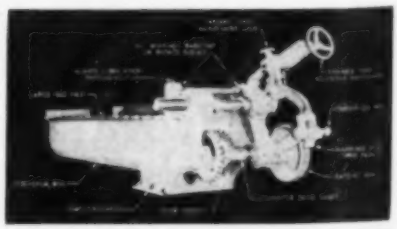
and V-bottoms within which the conveying mechanism runs. This mechanism is a pipe conveyor having synthetic rubber flights mounted on sealed pin chains. These pipe conveyors will operate in any plane, according to the manufacturer. Situated at a suitable point above the liquid level is the drive and discharge mechanism consisting of a motor, speed reducer, and adjustable take-up. A single sprocket with shear pin mounted on the drive and take-up assembly is the only fixed moving part. Elsewhere in the circuit the chain follows the bent pipe in several different planes. A ½-hp. motor is required for the smaller size an a ¾-hp. for the larger.

Correction

Automatic signaling and recording check weigher

THE EDITORS regret the inadvertent inclusion of the wrong view in an article, on page 139 of our August 1947, issue, describing a new electronic check weigher manufactured by the Fred Goat Co., 314 Dean St., Brooklyn 17, N. Y. The correct view is shown herewith .

13. Variable Feeder Drive



Double-ratchet-type variable speed feeder drive

FOR HEAVY-DUTY feeding of solid materials from wide-mouthed bins, Sprout, Waldron & Co., Muncy, Pa., has introduced the Type 2520 variable-speed feeder drive which consists of a screw conveyor and trough for attachment to the bin, combined with a double-ratchet drive mechanism operated through a crank and oscillating arm of variable length. Feed adjustment may be made in an infinite

LEWIS-SHEPARD FORK TRUCK

DEPENDABLE POWER

EXIDE-IRONCLAD POWER AND BATTERY ELECTRIC TRUCKS

They're saving time and cutting costs on materials handling jobs like yours

More and more companies, with operating conditions that closely parallel yours, have discovered the way to faster, safer and more economical handling of materials. They have given the job of lifting, hauling and stacking to the efficient battery electric truck and equally efficient Exide-Ironclad Batteries.

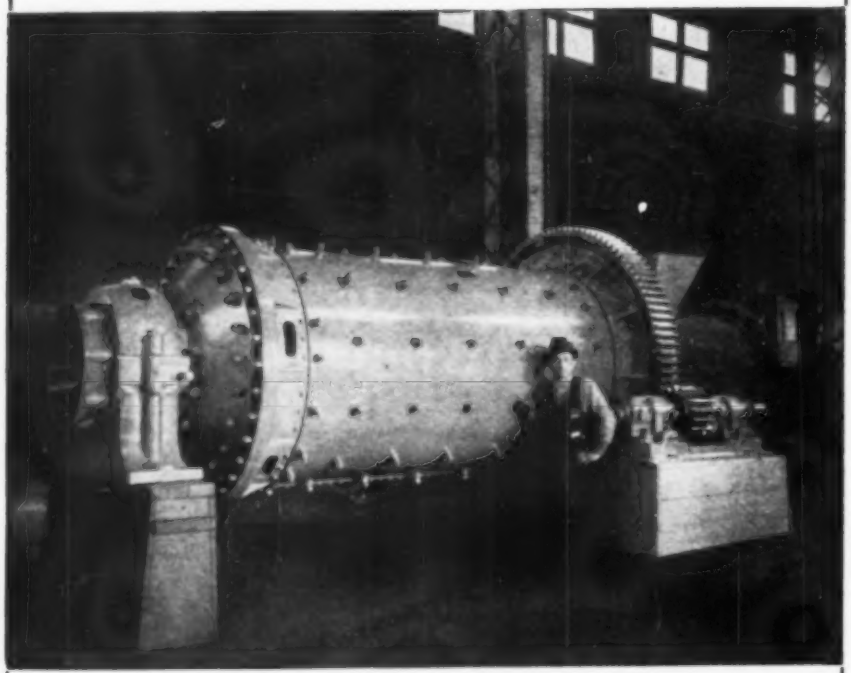
The high electrical efficiency of Exide-Ironclad Batteries is due largely to the unique construction of the positive plates. Each of these plates consists of a series of slotted, hollow tubes which contain the active material. So fine are these slots that, while they permit easy access of the electrolyte, they prevent the active material from readily washing out. Not only does this add to life of plates . . . and battery . . . it also provides higher power ability and capacity, assuring dependable, day long performance with maximum safety and minimum maintenance.

Write us for a FREE copy of Exide-Ironclad Topics, which contains "Case Studies" of materials handling problems. It tells how to cut handling costs up to 50% . . . covers latest developments in handling materials from receiving to shipping.

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

LEWIS-SHEPARD POWER JACKLIFT

For
"Straight-Through"
Grinding . . .
HARDINGE ROD MILLS



The Hardinge Conical-Ended Rod Mill is ideal for producing minimum oversize when grinding in open circuit. Grinds either wet or dry. Conical heads reduce friction—prevent congestion of material at the ends. Rods are self-aligning. Ask for Bulletin 25-B.

HARDINGE
COMPANY INCORPORATED
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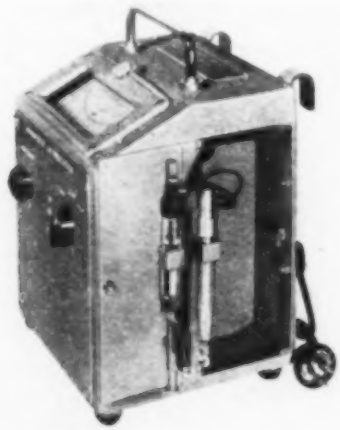
NEW YORK 17—122 E. 42nd St. • 205 W. Wacker Drive—CHICAGO 6
SAN FRANCISCO 11—24 California St. • 200 Bay St.—TORONTO 1

number of steps between the maximum and minimum capacities of the device and these adjustments may be made while the feeder is in operation. The equipment is provided with wide babbitted and bronze-bushed bearings carrying large diameter drive shafts. All parts are said to have been designed for minimum maintenance. The device is self-contained and easily installed, bolting directly to the conveyor box and requiring no intermediate couplings.

14. Portable pH Meter



Portable industrial pH meter

For most production applications as well as laboratory use, a new industrial model portable, direct-reading pH meter has been announced by Cambridge Instrument Co., 3705 Grand Central Terminal, New York 17, N. Y. The accuracy of the instrument is said to be 0.1 pH over its full range from zero to 14 pH. Operated from any standard lighting circuit, the device is 7½x8½x11¼ in. in size and weighs only 10 lb. In use only two adjustments are required for standardization. An improved galvanometer and circuit are said to result in extremely high stability. Recalibration is said ordinarily to be required not oftener than once a week. The electrode assembly, mounted on a door at the side of the metal case, is of the glass and calomel type, with automatic temperature compensation. A second automatic temperature regulator built into the galvanometer compensates for ambient temperature variations. The instrument is provided with a voltage

FOR MORE INFORMATION
See Reader Service
Coupon on pages 163-164

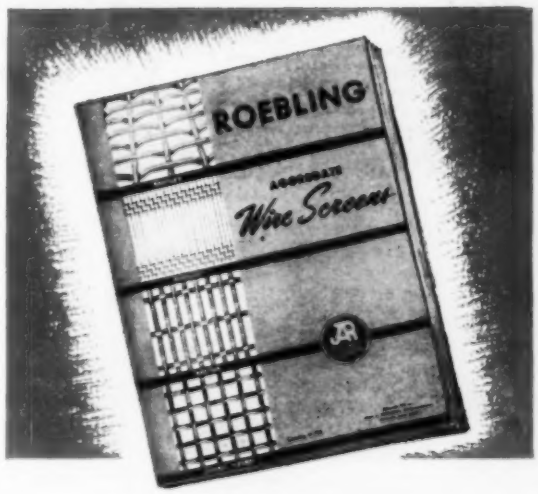
with ROETON

Now you can buy high tonnage screen made with an improved quality steel in the wires. It's Roebling Roeton . . . and it offers you new highs in open area plus far greater resistance to abrasion, wear and fatigue.

Roeton is available in 5 grades with wire diameters running from .007" to .375". Openings run from .008" to 1". Larger sizes are available in the new Roeflat construction that gives you over 75% more metal surface . . . up to 90% longer screen life.

Get all the facts on Roeton. You'll find them on pages 4 and 5 of the new Roebling wire screen catalog. Write for your copy of W-903 today.

Woven Wire Fabrics Division
JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities



SCREEN FACTS. The new Roebling Wire Screen Catalog complete with illustrations, descriptions and tables to give you full data on Roeflat, Roeton, Roeslot and Double Crimp. Ask for catalog W-903

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Manufacturers of Wire Rope and Strand • Fittings • Slings • Aerial Wire Rope Systems • Aircord, Aircord Terminals and Air Controls Ski Lifts • Electrical Wire and Cable • Suspension Bridges and Cables • Hard, Annealed or Tempered High and Low Carbon Fine and Specialty Wire, Flat Wire, Cold Rolled Strip and Cold Rolled Spring Steel • Screen, Hardware and Industrial Wire Cloth • Lawn Mowers

LUBRIPLATE maintains a durable, lead carrying film at the "Friction Point," which reduces friction, retards progressive wear and prevents rust and corrosion. That is why gears lubricated with LUBRIPLATE last longer and run better. Don't take our word for it. Prove it to yourself. Thousands have in every industry.

LUBRIPLATE

Lubricants definitely reduce friction and wear to a minimum. They lower power costs and prolong the life of equipment to an infinitely greater degree. LUBRIPLATE arrests progressive wear.

LUBRIPLATE

Lubricants protect machine parts against the destructive action of rust and corrosion. This feature alone puts LUBRIPLATE far out in front of conventional lubricants.

LUBRIPLATE

Lubricants are extremely economical for reason that they possess very long life and "stay-put" properties. A little LUBRIPLATE goes a long way.

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FISKE BROTHERS REFINING CO.

NEWARK 5, N. J. TOLEDO 2, OHIO

DEALERS FROM COAST TO COAST

CONSULT YOUR CLASSIFIED TELEPHONE BOOK

regulator to correct for line voltage fluctuations over a range from 100 to 130 volts. The meter is provided with rubber toes for bench or table use, as well as hooks for suspension over a tank or for mounting on a wall. An extension electrode assembly and extra length lead wires are available, if desired.

Equipment Briefs

15. WHERE fork trucks are used for moving materials from siding platforms onto rail cars, the Elizabeth Iron Works, P. O. Box 360, Elizabeth B, N. J., has designed a special bridge ramp which can be carried and placed by means of the regular forks on the truck, without any physical lifting. The manufacturer claims that it requires only two minutes, or less, of the time of one person to place a 15,000-lb. load capacity ramp between the platform and the car. The ramp contains a pair of lifting handles through which the forks project for carrying and placing. It also has locking pins which secure it in place to prevent shifting. Any gap from 5 to 58 in. can be spanned by means of this ramp.

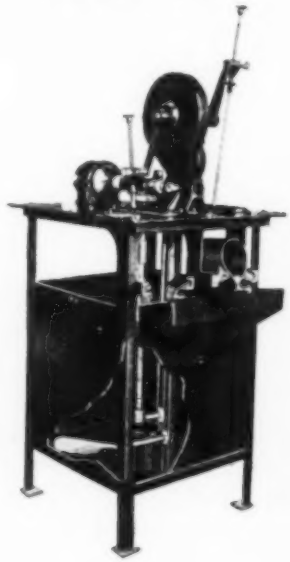
16. FOLLOWING its use in Europe for the past 20 years, Baker & Co., Newark 5, N. J., has introduced a cadmium-nickel alkaline storage battery which is said to combine the advantages of the lead-acid and nickel-iron alkaline batteries. The new battery is said to accept high or low charge rates with no finish rate limitations and it is claimed to have excellent capacities at low electrolyte temperatures without danger of damage due to freezing. It is claimed to have a minimum spread between its charge and discharge voltages and thus to be ideal for floating service applications.

17. A CAPACITY of 4,000 lb. is incorporated in the new pneumatic tired fork-lift truck, known as the Yardlift-40, introduced by Clark Tructractor Division of Clark Equipment Co., Battle Creek, Mich. This truck has been designated for working outdoors and on surfaces too uneven for solid-tired machines. The design is said to be new throughout. The truck has a heavy-duty transmission, providing a speed of 9.4 mph. in high and 2.9 mph. in low gear. Other features include a water pump and thermostatic control for more efficient engine operation, a high degree of maneuverability, and provision for easy tire change.

18. A CONVEYOR BELT with rayon cord plies as the strength member has been announced by the Manhattan Rubber Division, Raybestos-Manhattan, Inc.,

For Dependable Accurate Control

GEARY-JENNINGS FEEDER



There is a GEARY-JENNINGS model for every feeding requirement. Illustrated above is Type B with agitator for feeding liquids carrying solids in suspension, such as milk of lime. Other versatile models are available in single or multiple units.

The GEARY-JENNINGS FEEDER saves installation expense. The machine is self-contained. It maintains product uniformity by absolute accuracy and reliability of feed and permits adjustment in operation, yet it "stays put" regardless of viscosity or temperature.

Write for detailed information regarding Geary-Jennings Feeders.

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THE GALIGHER COMPANY

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Salt Lake City 8, Utah

EASTERN OFFICE
921 Bergen Avenue
Jersey City 6, N. J.

Ammonia

Amm

mmonia

Ammonia

DAYS CLOSER TO YOU...

ANHYDROUS AMMONIA:
Commercial grade: 99.5% NH_3; maximum moisture content, .05%. Typical Analysis: 99.95% NH_3; .03% moisture; 2-3 ppm oil.

AQUA AMMONIA:
26° Baume grade, 29.4% NH_3 content. Color: water white. No H_2S or pyridine content.

For orderly, "as planned", deliveries, it pays to schedule your orders from Spencer's centrally located Pittsburg, Kansas, works, which is hundreds of miles and days closer to you. Phone or wire us today.

SPENCER

SPENCER CHEMICAL COMPANY

Executive and Sales Offices, Dwight Bldg., Kansas City 6, Mo.
Works, Pittsburg, Kansas

NUFACTURERS. OF CHEMICALS FOR INDUSTRY AND AGRICULTURE

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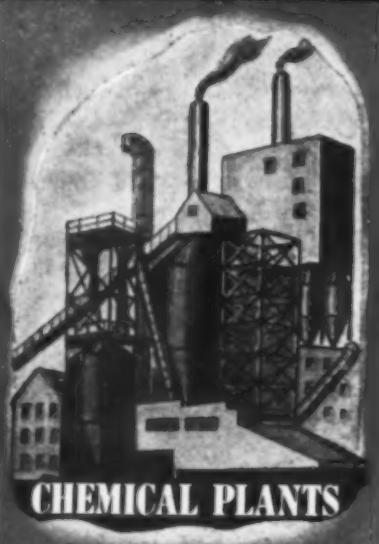

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PILOT PLANTS - FULL SCALE PLANTS

PROJECT ENGINEERING CO.

115 FULTON STREET
NEW YORK 7, N.Y.

Passaic, N. J. The new belt is designed for heavy duty applications, such as the handling of coal, ores, and limestone. It is said to trough easily, thus utilizing conventional type idlers and pulleys. It can be field-spliced by conventional methods.

19. BOTH PLATFORM and pallet types are available in a new line of hand-guided, motorized lift trucks offered by Lift Trucks, Inc., 2425 Spring Grove Ave., Cincinnati 14, Ohio. Known as Model K Hydrolectric, the truck is said to combine features previously unavailable in standard industrial trucks. All sizes have a 4,000-lb. capacity with two forward speeds and two reverse, plus dynamic braking. A feature is the use of a two-wheel front drive. All speeds and the brake are instantly controlled by three pushbuttons contained in the steering handle.

20. A SIMPLE drum truck incorporating a 1½-ton automobile hydraulic jack to provide the lifting has been developed by Allied Welding & Mfg. Co., 49 Lorna Doone Blvd., Orlando, Fla. The design fits a standard metal drum and permits it to be readily attached to the truck, lifted and transported to the new location. The overall height of the device is low to permit drums to be stored two or more deep under drum-height shelving.

21. A VARIETY of corrosion resisting construction materials are used for a new line of fittings for butt welding or silver brazing, introduced for chemical plant use by Northern Indiana Brass Co., Elkhart, Ind. These fittings, in sizes from ¼ to 4 in., can be produced in Inconel, nickel, Monel and stainless 304, 347 and 316. A metal tag permanently welded on each fitting gives necessary information to enable the exact matching of metallurgical and physical characteristics of pipe and fittings at any time in the future.

22. A HINGED RACK, adapting the machine to both low and high skids, is now available with platform type motorized hand trucks produced by the Automatic Transportation Co., 149 West 87th St., Chicago, Ill. This hinged rack stands upright at the front of the truck's platform when low skids are being handled, and is lowered to lie flat on the platform to give added height when high skids are lifted.

FOR MORE INFORMATION
See Reader Service Coupon on pages 163-164

Sixty years of specialized experience in making industrial wire mesh fabricated parts, is available to you . . . assuring better performance at reduced costs. Production is completely controlled from designing, drawing, weaving and fabrication to final assembly and delivery. Jelliff's competent engineers welcome the opportunity to analyze your specific requirements and submit practical and economical recommendations.

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The C. O. JELLIFF MANUFACTURING CORPORATION
SOUTHPORT, CONN.

WIRE PRODUCTS SINCE – 1880

NEW PRODUCTS AND MATERIALS

Richard W. Porter, ASSISTANT EDITOR

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FOR MORE INFORMATION

See Reader Service Coupon on pages 163-164

51. Hydrated Silicate

IN A COLLOIDAL form called Attasol, attapulgite, a complex hydrated magnesium aluminum silicate, is now being produced by the Attapulgus Clay Co., West Washington Sq., Philadelphia 5, Pa. Attasol is unique in that it disperses readily in aqueous media, forms stable viscous suspensions with gel-forming properties and its colloidal dispersions, which are not flocculated by electrolytes, exhibit adsorptive and detergent powers. A flowable white, non-abrasive powder with a bulk density in the order of 30 pounds per cu.ft., it is made up of slender, elongated fibers or spicules as shown by the electron microscope. Chemically inert to most reagents, it depends on surface energy and sorptive action for its effectiveness. When used in distilled water, pH lies between 6.5 and 7.5. In media whose pH differs from neutrality there may be some change in pH due to Attasol's sorptive action, indicating its use for precision control of pH. The presence of salts, acids or bases have relatively little effect on its dispersions. As a washing powder, it is compatible with caustic soda, soda ash, silicates and phosphates used in washing severely soiled fabrics and may be used in place of all or part of the soap customarily employed. Its surface activity and the stability of its gel suggest many uses as a frothing, flotation and emulsifying agent, with special values where an electrolyte makes up a major phase of an emulsion.

52. Chemical Intermediate

UTILIZING toluene and ammonia by combining them in the vapor phase with the assistance of a catalyst, the Socony-Vacuum Oil Co., Inc., 26 Broadway, New York 4, N. Y., has started the manufacture of benzonitrile on a pilot-plant scale. Quantities sufficient for study by research investigators and development engineers will be produced at Paulsboro, N. J. A colorless liquid with a pleasant odor resembling that of oil of bitter almonds, benzonitrile has a boiling point of 375 deg. F., a weight of 8.35 lb. per gal. and a freezing point of 9 deg. F. It is soluble in common organic solvents such as alcohol, carbon tetrachloride and ether and is essentially insoluble in water. In the production of synthetic resins, pharmaceuticals and dyestuffs, this company expects wide usage for benzonitrile. It is said to be an effective solvent for vinyl resins. Benzonitrile may have insecticidal properties and shows promise as a softening agent for natural rubber as well as an intermediate in the development of new rubber chemicals.

53. Salts of Naphthenic Acid

OF RESEARCH interest as potentially valuable commercial products are eleven metallic salts of naphthenic acids now available in experimental quantities from the Advance Solvents & Chemical Corp., 245 Fifth Ave., New York 16, N. Y. Prepared from highly refined naphthenic acids typical of the carboxylic acids obtained from petroleum, Soligen Special Metallic Naphthenates are claimed to have advantages over salts of vegetable or rosin fatty acids. They have better solubility in the usual commercial solvents and better stability to hydrolysis. Breakdown by oxidation or bacteria is not as common with them. In general, the metallic salts of naphthenic acids are good in applications requiring high solvency and stability. Naphthenic acids can be separated into a variety of ranges of molecular weights by distillation. Mercuric Naphthenate is useful in the treatment of ropes, cordage used in rubber tires, canvas, wood, leather and painted metal surfaces in retarding the growth of bacteria, mold and marine life. Both sodium and potassium naphthenate have good emulsification characteristics. They may be used as bodying agents for paint solvents and water, in the preparation of stable emulsions of artificial lastex, and the resolution of stubborn water-in-oil petroleum emulsions. In conjunction with oils and other petroleum naphthenates they can produce soluble oils, cutting oils, castor machine oil,

Properties of Soligen Special Metallic Naphthenates[1]

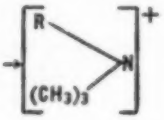
Metallic Naphthenates	Percent Metal	Percent Free Naphthenic Acid	Appearance	Solubility
Barium	22.6	Nil[2]	Buff powder	Slight Solubility in mineral spirits
Cadmium	18.9	1+[2]	Light brown solid	Slight Solubility in mineral spirits
Chromium	6.1	9[2]	Blue-green solid	Soluble in mineral spirits
Lithium	2.85[4]	0.9[3]	Amber semi-solid	Soluble in water, alcohol, mineral spirits
Mercuric	29.0	1[2]	Brown semi-solid	Soluble in mineral spirits
Nickel	10.8	1−[2]	Green solid	Soluble in mineral spirits
Potassium	13.1	0.9[3]	Medium brown	Soluble in water and alcohol
Sodium	8.6[3]	1.7[3]	Light brown solid	Soluble in water and alcohol
Strontium	15.5[4]	....	Buff powder	Soluble in aromatic spirits ester solvent
Tin	20.0[4]	1.8[3]	Amber brown solid	Soluble in mineral spirits
Vanadium	6.7[4]	0.8[3]	Metallic gray solid	Soluble in mineral spirits

[1] Prepared from 240 combining weight naphthenic acids. [2] Estimated from theoretical metal content. [3] Determined by titration. [4] Theoretical.

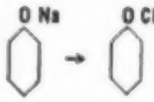
UTILIZATION OF ANSUL CH_3Cl

These examples illustrate a few specific applications for Ansul Methyl Chloride in research laboratory and industrial practices:

GRIGNARD . . . . . $CH_3Cl + Mg \rightarrow CH_3MgCl$

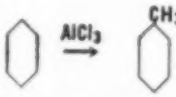
QUATERNARIES . . . . $CH_3Cl + RNH_2 \rightarrow$  Cl^-

ALIPHATIC ETHERS . $CH_3Cl + NaOR \rightarrow CH_3-O-R + NaCl$

AROMATIC ETHERS . $CH_3Cl +$  $+ NaCl$

ALIPHATIC HYDROCARBONS . . . $CH_3Cl + RNa \rightarrow CH_3-R + NaCl$

AROMATIC HYDROCARBONS . . . $CH_3Cl + Na +$ $+ NaCl$

" " . . . $CH_3Cl +$  $+ HCl$

SILICONES . . . . . $SiCl_4 + 2CH_3MgCl \rightarrow (CH_3)_2SiCl_2 + 2MgCl_2$

In addition Ansul Liquid Methyl Chloride is being currently used as a low temperature solvent • propellent solvent • extractant • refrigerant • **and in other laboratory and industrial processes.**

Methyl Chloride is a low priced chemical available in tank cars and large and small cylinders.

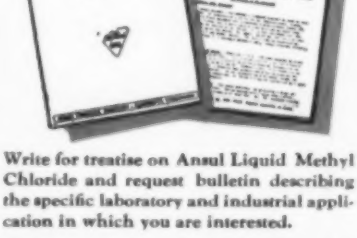
LIQUID Methyl Chloride ANSUL*

PHYSICAL PROPERTIES

Chemical formula	CH_3Cl
Molecular weight	50.491
Color (gas or liquid)	Colorless
Odor	Ethereal, non-irritating
Melting point	−144° F. (−97.6° C.)
Boiling point	−10.65° F. (−23.7° C.)
Critical Temperature	289.6° F. (143.1° C.)
Critical pressure	969.2 lbs. per sq. in. abs.
Solubility	Methyl chloride in water—3 to 4 volumes methyl chloride vapor in 1 volume of water at ordinary temperatures and atmospheric pressure—methyl chloride in alcohol—readily soluble.
Specific gravity of liquid	.909

*REG. U. S. PAT. OFF.

Consult Ansul's research and technical departments on these and other applications of Methyl Chloride.



Write for treatise on Ansul Liquid Methyl Chloride and request bulletin describing the specific laboratory and industrial application in which you are interested.

***For your* SULFUR DIOXIDE *applications . . . . Use* ANSUL SULFUR DIOXIDE**

ANSUL CHEMICAL COMPANY
INDUSTRIAL CHEMICALS DIVISION, MARINETTE, WIS.
60 E. 42nd St., New York — 535 Chestnut St., Philadelphia

greases, etc. A large capacity for hydrocarbons and good foaming characteristics in water enhance the value of these alkali naphthenates in emulsification and detergent work. As impregnating agents for fibrous materials, they combine with heavy metals such as aluminum sulphate to form water-repellents. Similarly, sizing agents may be made of them when washed by metallic salts. They are suggested as binding agents for briquetting sawdust and other wood wastes for fuel. When mixed with water-soluble binders, they may have properties useful in adhesives. When barium and other heavy naphthenates are heated, they give hard, resinous materials which are binding and plasticizing agents for linoleum and mastic manufacture. They may also be used as resinous type glues, the harder derivatives finding applications as agents for increasing the final hardness and waterproofness of glues and adhesives. Strontium and chromium naphthenate may be of value in treating the surfaces of bearings and other metallic parts in order to obtain special properties. Chromium naphthenate has had some success in retarding the chalking of exterior paints. Cadmium, barium and nickel naphthenate catalyze hydration and also the oxidation of hydrocarbons to form hydroxy and carboxy derivatives. Lithium naphthenate functions as a catalyst for the alcoholysis of fatty acids. Tin naphthenate functions as an addition agent for lubricating oils, an anti-oxidant when compounded into lubricants and a stabilizer to inhibit the degradation of polymers and hydrocarbon oils.

54. Aluminum Roofing

SUCCESSFULLY employed in Army and Navy construction during the war, aluminum roofing and siding material is now in production at the Aluminum Co. of America, 801 Gulf Building, Pittsburgh 19, Pa., for use in industrial and farm buildings. Alcoa Industrial Roofing is made from a lightweight, heavy-duty aluminum alloy to combine reduced roof load with strength, resistance to industrial atmospheres and minimum maintenance. Both the roofing and siding cover a width of 32 in. allowing for a side lap of 1¼ corrugations and will come in standard five-foot through twelve-footh lengths. They meet safe load requirements and will be offered for sale through normal channels of distribution. All necessary fittings will be supplied.

55. Silica Coating

A NEW coating material called Silcote has been developed by the National Research Corp., 70 Memorial Dr., Cambridge 42, Mass. Applied by high

From the Home of New Processes
for American Industry

YOUR NEW

FLOW-MASTER CATALOG IS READY

The new FLOW-MASTER Catalog No. 40 is the book that shows progressive producers in the process industries new ways to obtain fast, efficient, low-cost production. It describes not only the FLOW-MASTER Homogenizers, Kom-Bi-Nators and Pumps, but the new FLOW-MASTER Reactor, Temperer, and Roto-Feed Continuous Mixer.

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Newark Wire Cloth COMPANY

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vacuum evaporation from a tungsten, molybdenum or tantalum boat at 1,500 deg. C., subsequent heat treating in air for eighteen hours at 300 deg. C. affords maximum protection. Tests made by the company show mirrors protected with Silcote to be 1600 times more resistant to abrasion than an unprotected mirror. The material is easily briquetted to form standard pellets.

56. Vinyl Cyclohexene

PRODUCTION of vinyl cyclohexene has been extended to commercial proportions by the Koppers Co., Inc., Pittsburgh 19, Pa. An unconjugated diolefinic hydrocarbon, it offers possibilities to the producers of synthetic organic chemicals. Since it does not polymerize readily, storage under normal conditions is possible. The commercial product contains no inhibitor.

57. Vulcanizing Cement

DEVELOPED to produce the best possible bond between rayon and rubber, a new vulcanizing cement is said to produce stronger and better repairs on rayon cord tires. It is claimed that the high degree of penetration provides a better mechanical anchorage to the rayon-cord as well as to the rubber between the cords. This new vulcanizing cement made by United States Rubber Co., Rockefeller Center, New York, N. Y. is said to be useful for cotton and nylon cord tires.

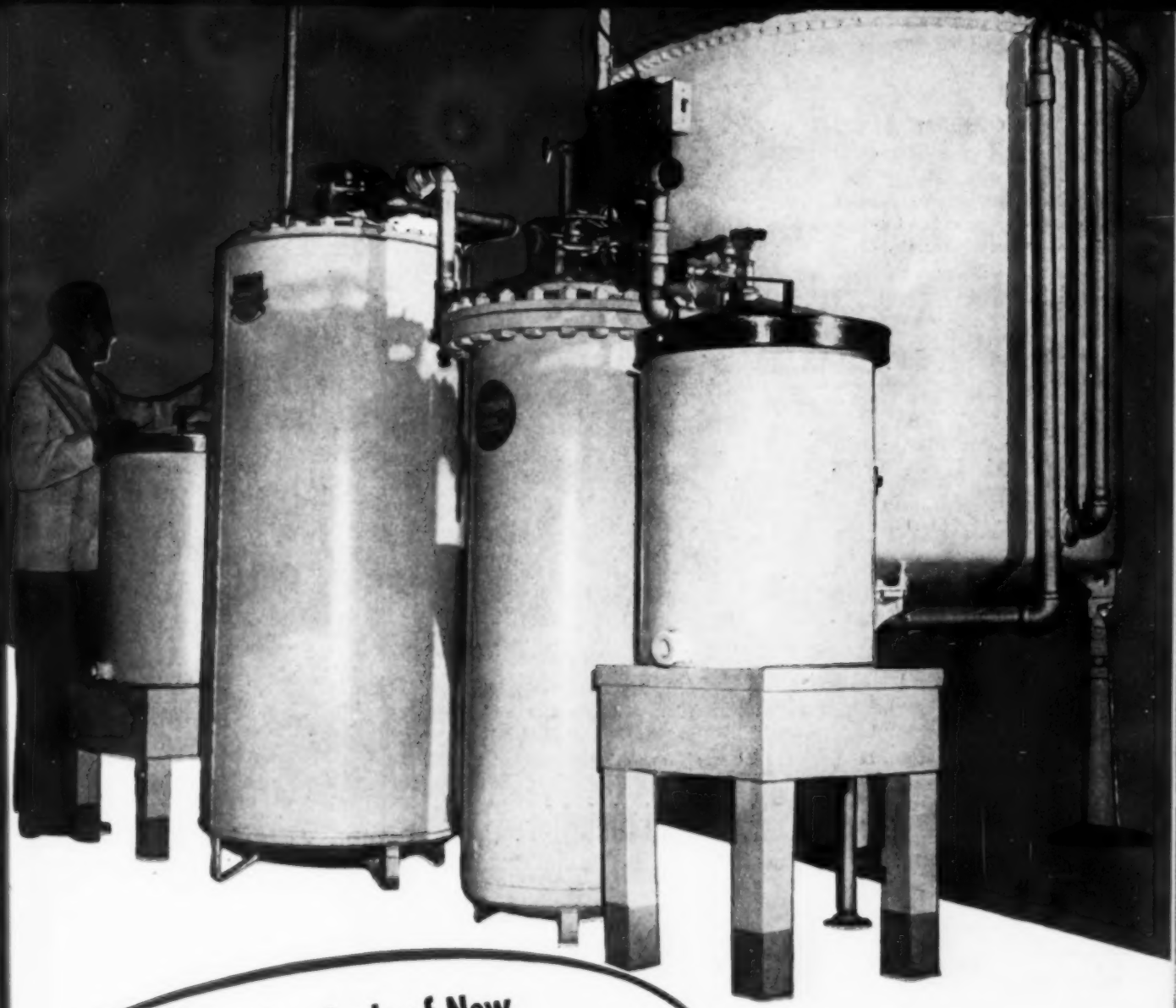
Another new product, an oil-resistant compound for splicing electrical wire has also been announced by this company. This compound is made of neoprene rubber combined with special synthetic materials. It is recommended for use on any electrical circuit coming in contact with oil. It will be available in the form of tape ¾ in. wide, 0.030 in. thick, and 30 ft. long.

58. Masonry Coating

DEVELOPED by the Truscon Laboratories, Detroit, Mich., is a protective and decorative coating for concrete and other masonry buildings. Formulated with chlorinated rubber, Para-StonTex has been satisfactorily tested by the manufacturers for its ability to resist the destructive effects of alkali, the hydrolyzing action of water, and atmospheric exposure. It is available in white and in various colors.

59. Commercial Starch

AGAIN available in large quantities is Amioca, a commercial starch manufactured by the National Starch Products Inc., 270 Madison Ave., New York, N. Y. The product is obtained



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This machine reconditions the chimes of used steel drums. At one operation it will straighten the chime even though the chime is very badly bent or distorted, bringing same into round as originally made and at the same time high hydraulic pressure compresses and rolls the chime preventing leakage in any properly made drum. When it is desired to shear the top, or bottom from drums this can be accomplished by substituting a shearing wheel, (which is furnished with the machine) for the pressure wheel. This substitution can be made quickly. The head or bottom can be cut from the drum cleanly and without leaving jagged edges. The chime is straightened and brought into round in this operation also. The entire time required for any operation is just a fraction of a minute for each end of drum.

Chime Machine
Model DM-1
Universal
Electro-Hydraulic

Originators and Builders of Drum Reconditioning Machinery. This machine is in use throughout the U S. A. and in many foreign countries.

Our best salesmen are the machines we build.

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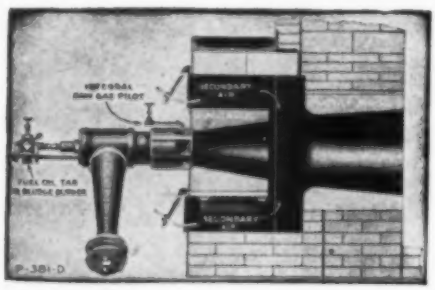

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Maintains a high flame temperature with either fuel oil or gas . . .

and is easily "lighted off" in a cold furnace . . . with fuel oil or gas. It can be brought, quickly, to full capacity with a clean flame; has a high turndown ratio with a steady flame; and can be applied to all types of boilers and process furnaces. The flame can be regulated and directed to uniformly radiate heat to the absorbing surfaces without flame impingement.

This unit is also designed for firing vertically upwards and for forced draft preheated air when necessary. ***For further information about Tandem Combustion Units, write***

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See Reader Service
Coupon on pages 163-164

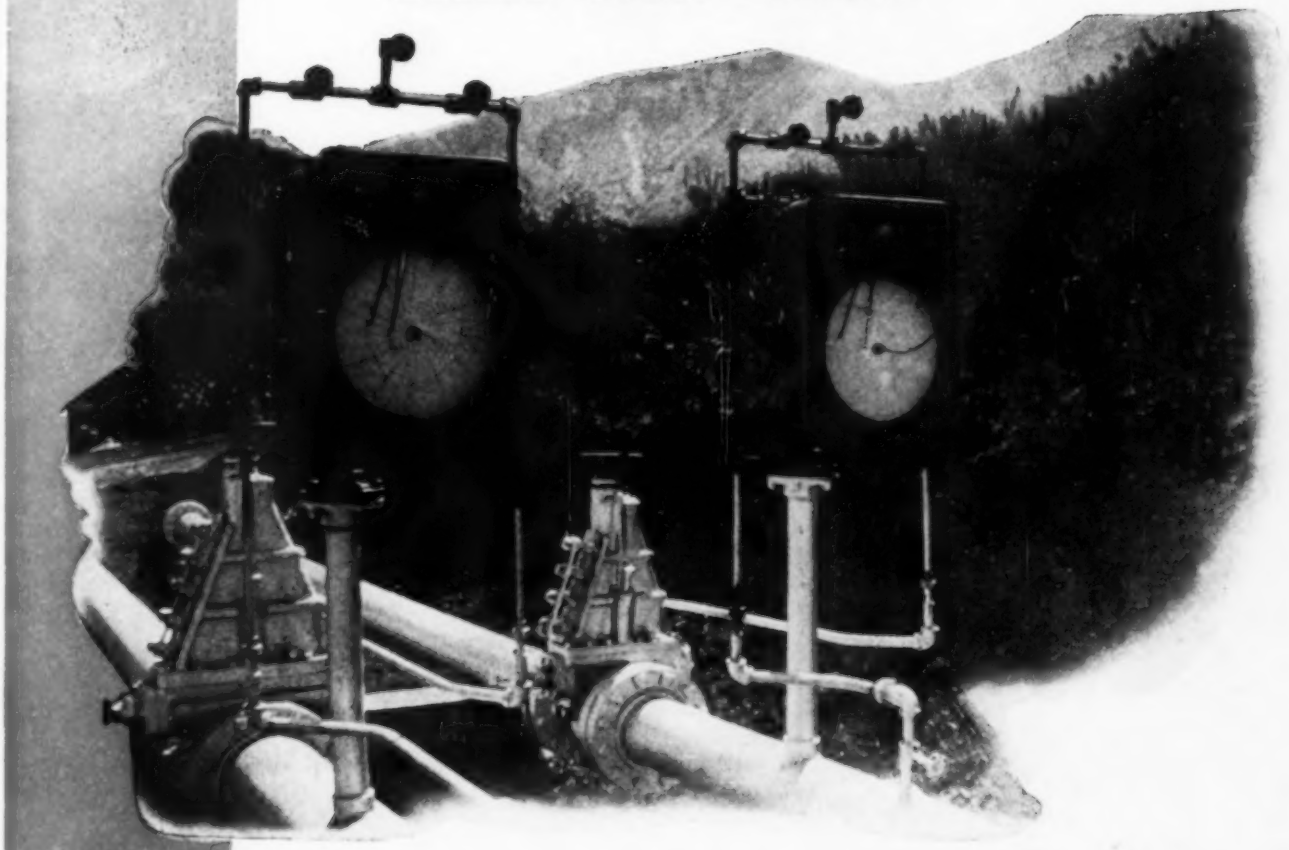
from a domestic waxy maize. Unlike other commercial starches which contain from 20 to 30 percent amylose, it is entirely composed of amylopectin, generally believed to be a non-linear polymer of glucose. The highly hydrated molecules of amylopectin cannot associate readily and so give rise to highly viscous, clear, cohesive pastes, free from the tendency to jell on aging. In the paper field these properties qualify Amioca to provide beater sizings that are non-jelling and permit a high degree of hydration. Similarly, paper coatings utilizing this material have high solids and good binding power.

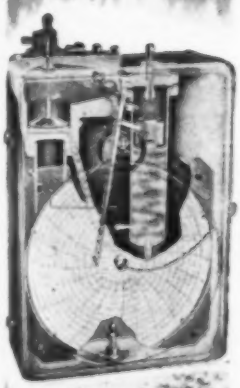
59. Organic Peroxides

PILOT PLANT manufacture of four recently developed peroxides is now under way by the Union Bay State Chemical Co., 50 Harvard St., Cambridge 42, Mass. The four peroxides are as follows: t-butyl perbenzoate, di-t-butyl diperphthalate, and 1-hydroxycyclohexyl hydroperoxide-1, t-butyl hydroperoxide. T-butyl perbenzoate is a straw-colored liquid peroxide with a specific gravity of 1.04 at 15 deg. C., having a sharp penetrating odor. It is easily miscible with many monomeric materials and effectively catalyzes them, and because of its high decomposition point and the nature of its decomposition, forms clear bubble-free films. It is stable through prolonged heating at 75 deg. C. and decomposes completely at 130 deg. C. It contains 8 to 8.5 percent available oxygen and is readily flammable when ignited. However, the combustion of fine divided organic material saturated with this liquid is not dangerously accelerated. T-butyl perbenzoate has a molecular weight of 194, a vapor pressure of less than 100 mm. of mercury at 100 deg. C., decomposes at 113-116 deg. C., freezing point of −20 to 4 deg. C. It is soluble in all proportions in all common organic solvents. It is stable over iron, aluminum, copper, zinc, tin and decomposes slowly over lead. It is insensitive to shock, rubbing and grinding. This liquid peroxide is suggested for use wherever organic peroxides are of interest; as an effective catalyst in bulk polymerization; as a good high temperature polymerization catalyst.

The second of these organic per-

Where Low-Cost Accuracy Saves Time and Labor





OUT IN THE FIELD, where maintenance is infrequent and tough conditions call for dependable measurement, you'll find that METRIC American Orifice Meters pay off in low-cost accuracy.

When adjustment becomes necessary, simple, functional design makes this quick and easy. Only three tools — screw driver, wrench and pliers are needed.

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METRIC American's low-cost accuracy and easy-to-service design, proved the world over, are the result of years of measurement engineering.

Technical literature, on Indicating, Recording or Integrating Flowmeters, Pressure Regulators, Liquid Level and Flow Controllers will be mailed on request.

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It's alloyed to meet a highly corrosive condition. It's centrifugally cast to give it the higher strength and greater metal density to meet a tough structural requirement. It's typical of what we can do in our centrifugal casting department. In this case two sections were made and welded together.

May we suggest that if you have need for any high alloy pipe or tube ranging in diameter from 2½ inches to 24 inches and, depending on diameter, up to 15 feet in length, you look into our centrifugal casting service.

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oxides is di-tertiary butyl diperphthalate which is solid in form and which contains 10.31 percent active oxygen. This material consists of white crystalline granules with a molecular weight of 310.34, a melting point of 57-57.5 deg. C., has good stability at room temperature and is soluble in organic solvents but insoluble in water. It is suggested for use as a catalyst and for polymerization of vinyl and olefinic monomers, as a high temperature polymerization catalyst, and as a bleaching agent.

1-hydroxycyclohexyl hydroperoxide-1 is a cycloalkanyl peroxide in white crystalline solid form that is stable at room temperature and possesses 12.12 percent active oxygen. It has a molecular weight of 132, melting point of 76.78 deg. C., thermo decomposition point of 71 deg. C., is stable at room temperature and is soluble in organic solvents, but insoluble in water. It is suggested for use as a mild oxidizing agent, as a catalyst for various polymerizations, as a bleaching agent, as a drying accelerator in paints, oils and varnishes, and as the ingredient source of active oxygen in face creams and similar products. It is somewhat sensitive to shock and is decomposed with some violence under certain conditions.

The fourth of these compounds is 60 percent tertiary butyl hydroperoxide. This material is a water white liquid with a specific gravity of 0.860 at 15 deg. C. and has a sharp penetrating odor. It has a molecular weight of 90, boiling point of 90-107 deg. C., freezing point —35 deg. C., flash point 18.3 deg. C., pH in 10 percent water solution of 4, available oxygen 10.6 percent. Thermo decomposition takes place at 89 deg. C. but it is stable through prolonged heating at 75 deg. C. It contains 40 percent di tertiary butyl peroxide. This material is soluble in aromatics, short chain aliphatics, but only slightly soluble in water. While manufacture of the above chemicals is still in pilot plant stage, sizeable quantities can be produced if desirable.

60. Wood By-Products

LARGE quantities of two new types of wood by-products are now available from the Masonite Corp., Laurel, Miss. The first of these is a water soluble hemicellulose derived from the hydrolysis of wood, while the second is a fine hydrolyzed lignocellulose fiber considerably enriched in lignin content. The hemicellulose consists of about 70 percent wood sugars, 10 percent modified lignin and some 20 percent of organic resins and gums. The ash content is low and the pH of the water solution is about 4.0. A

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SLO-SPEED

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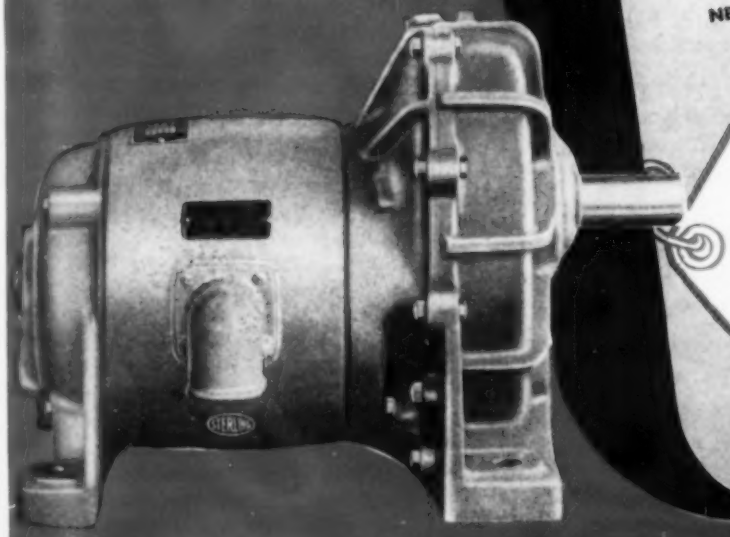

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"Fire protection here calls for instant detection—and prompt extinguishing"

Fire in a plant powerhouse *could* result in a lengthy shutdown —and the need of costly power purchases from outside sources.

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When *Kidde* Systems, Wheeled Units and Portables protect your electrical equipment, fires are quickly and safely extinguished. *Kidde* equipment discharges *only* clean, non-conducting carbon dioxide—and discharges it entirely by its own stored energy.

No danger of short circuits or flashovers. No corrosion of metal parts . . . no risk of damage to insulation. No danger of the extinguishing equipment failing because pumps or other power sources are shut down!

There may be *other* fire hazards in your plant where the advice of a Kidde representative would be helpful. He's always ready to discuss your fire protection problems with you.

Walter Kidde & Company, Inc., 928 Main Street, Belleville 9, N. J.

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Kidde

FIRE PROTECTION HEADQUARTERS

portion of the material is colloidally dispersed rather than dissolved in the water. A mild hydrolysis with mineral acid will precipitate this dispersed material giving a clear solution of free hexose and pentose sugars together with certain other organic complexes. This solution can be further clarified and fermented to ethyl alcohol, butyl alcohol, acetone, glycerine and citric acid by various methods. It is said to be a good emulsifying agent producing stable emulsions with various types of water immiscible materials and has pronounced foaming characteristics with excellent foam stability. At the present time it is finding applications as a binder in various fields, including powdered coal, foundry cores, and water treating chemicals. It is available as a 55 percent concentrate in water under the trade name of Masonex and as a spray dried powder known as Masonoid.

The second of the products is known as Benaloid 1,000, and is comprised of fine fiber and fiber particles. It is hydrolyzed lignocellulose and consists of approximately equal amounts of lignin and partially degraded cellulose. It is readily compatible with nearly all thermoplastic resins and with thermosetting resins of the phenolic, furan, urea and melamine types. Its plasticity in common with such resins considerably reduces the amount of resin required for satisfactory molding. Benaloid 1,000 is marketed as less than 80 mesh powder packaged in 50 lb. multi-wall water proof paper bags.

Both of these products result from the Masonite process of exploding wood with steam pressures up to 12,000 lb. per sq. in. Acetic and formic acids formed by this high temperature steam treatment of the wood results in an acid hydrolysis and renders water soluble the major portion of the hemicellulose fraction. The soluble hemicellulose and the fine fibers and fiber particles are separated from the usable fibers which are employed in board manufacture.

61. Household Detergents

Now being marketed by the Westinghouse Electric Appliance Division, 306 Fourth Ave., Pittsburgh, Pa., is a new synthetic detergent for use in automatic home washers. With the brand name "All" the material developed in cooperation with the Monsanto Chemical Co. is claimed to work equally well in hard or soft water thus not requiring the water to be softened. In developing this new soap, a wide variety of detergents, bar soap and soap flakes were tested in an effort to find the most satisfactory product for all-around home laundry work.

CHEMICAL ENGINEERING NEWS

Richard F. Warren, ASSISTANT EDITOR

First Peacetime Atomic Pile Going Up at Brookhaven

CONSTRUCTION of the first peacetime atomic pile began in August at Brookhaven National Laboratory, New York. The $10 million pile will be used in fundamental research in medicine, physics, biology, chemistry, and engineering. Construction commenced with ground-breaking ceremonies held in the presence of members of the United States Atomic Energy Commission, guests and laboratory employees, officers of the H. K. Ferguson Co., which will construct the pile, and trustees and officers of Associated Universities, Inc., which operates the Laboratory.

The pile is expected to be completed and in operation by mid 1948. Though not the largest, it will contain a number of improvements that will make it the most flexible research pile in the world. There will be facilities for bringing out neutron beams, for irradiating biological tissues and for making studies of the characteristics of neutrons. Provision has been made for special research on materials used in connection with construction and operation of atomic piles, and also on the engineering problems involved in atomic power production.

In general form, the Brookhaven unit will be similar to the Oak Ridge pile, except that the neutron density will be several times greater. It will be able to produce radioactive materials as does Oak Ridge. Such materials will be used in research primarily at Brookhaven, but they will also be available, when not obtainable elsewhere, to research institutions throughout the northeastern states.

The air-cooled pile will be housed in a building 120 feet long by 100 feet wide, and more than six stories in height. The building will be flanked by two wings, each nearly 100 feet long, which will contain laboratories.

The pile is the first large item of atomic equipment upon which construction has been started at Brookhaven Laboratory. Other equipment to be constructed include a "hot" laboratory for use in research on radioactive materials, a large cyclotron, and a Van de Graaff generator. Under preliminary study is a huge proton accelerator capable of producing a beam of atomic particles at 10 billion electron volts, with which atomic scientists hope to be able to create matter out of energy.

Stanolind and U.S.I. Form Sales Agreement

THE RECENTLY announced contract between Stanolind Oil and Gas Co. and U. S. Industrial Chemicals, Inc. covers the sale of water-soluble oxygenated hydrocarbon chemicals produced both by the synthetic gasoline plant planned for construction by Carthage Hydrocol, Inc. and the plant to be erected by Stanolind Oil and Gas Co. according to E. F. Bullard, president of Stanolind. Stanolind plans to build chemical recovery and separation plants adjacent to each of the synthetic gasoline plants and plans to refine the byproduct chemicals to meet current trade specifications. U.S.I. plans to build plants at the two locations to manufacture an additional line of chemicals using part of the Fischer-Tropsch chemicals as raw materials. Chemicals not consumed by U.S.I. in its operations will be sold as such.

Each of the synthetic gasoline plants is expected to produce upwards of 100 million pounds per year of water-soluble oxygenated hydrocarbons. These chemicals for the most part consist of straight-chain alcohols, aldehydes, acids and ketones containing from two to four carbon atoms per molecule. Production will start in about two years.

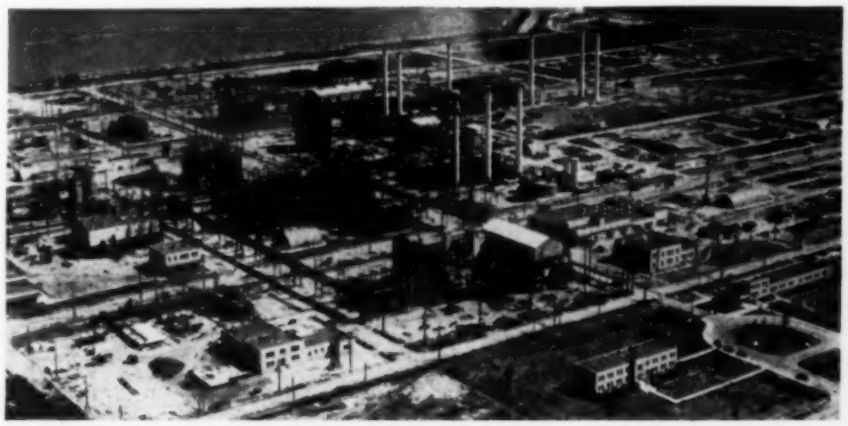
Stanolind has not yet completed its plans for refining and marketing the higher molecular weight alcohols, acids, aldehydes and ketones containing five to twelve or more carbon atoms per molecule, which will be produced by the two synthetic gasoline plants.

TAPPI to Hold National Fall Meetings

THE Technical Association of the Pulp and Paper Industry will hold the following national fall meetings: Plastics, September 25-26, Syracuse, N. Y.; Alkaline Pulping and Chemical Products, October 9-11, Asheville, N. C.; Fiberous Agricultural Residues, October 23-24, Alton, Ill.; and Second Engineering Conference of the Pulp and Paper Industry, November 3-5, Philadelphia.

Glyco Starts Chlorobenzene Output in West Virgina

FORMER Chemical Corps' Marshall Plant at New Martinsville, West Va., acquired several months ago by Glyco Products Co., Inc., Brooklyn, N. Y.,



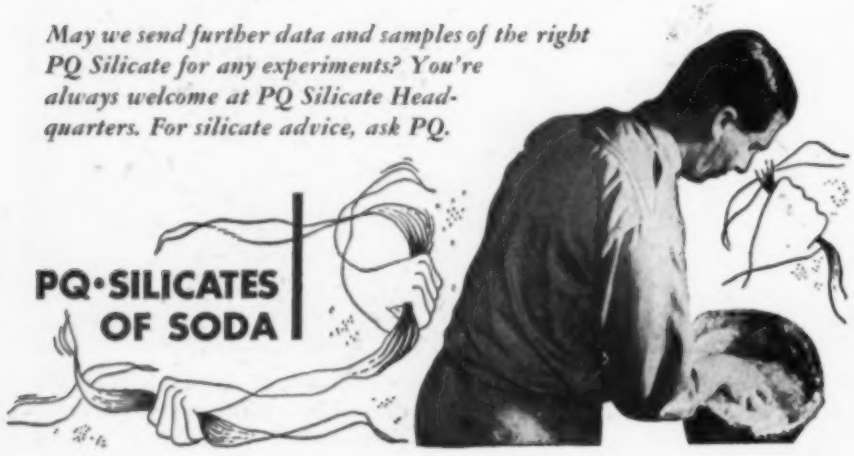
Manufacturing Nylon salt, the Sabine River works of E. I. duPont de Nemours & Co., at Orange, Tex., is being expanded to provide facilities to produce polythene and synthetic methanol

PQ Silicate is a paper maker's friend (and yours too as a consumer of paper) for the precipitate it forms with aluminum sulphate catches in the fibres, holds on to the little short ones. Besides, it keeps more of the clay and fillers right in the sheet. The result of this action produces a sheet that is smoother, harder and stronger.

Can you use this principle in one of your processes to improve the result or cut its cost? Reactions with PQ Silicate and other chemicals such as hydrochloric acid, chlorine, hydrogen peroxide, calcium chloride, sodium bicarbonate may furnish the answer to one of your problems.

PHILADELPHIA QUARTZ COMPANY
119 S. Third St., Philadelphia 6, Pa.

May we send further data and samples of the right PQ Silicate for any experiments? You're always welcome at PQ Silicate Headquarters. For silicate advice, ask PQ.



has started production of mono-chlorobenzene and ortho- and para-dichlorobenzene with additional products scheduled as other processing units can be activated. Present equipment, plus new equipment to be transferred from Brooklyn and new units that have been ordered will be used for the manufacture of other organic chemical derivities. Plans call for early reactivation of a second and larger group of processing buildings. A new steam

CONVENTION CALENDAR

American Chemical Society, 112th national meeting, New York, September 15-19.

National Petroleum Association, 45th annual meeting, Hotel Traymore, Atlantic City, N. J., September 17-19.

Technical Association of the Pulp and Paper Industry, fall meeting on plastics, Syracuse, N. Y., September 25-26.

American Institute of Chemical Engineers, regional meeting, Hotel Statler, Buffalo, N. Y., September 29-October 1.

Packaging Machinery Manufacturers Institute, 15th annual meeting, Hotel Sheraton, Springfield, Mass., October 6-7.

American Society of Mechanical Engineers, national conference on petroleum mechanical engineering, Rice Hotel Houston, Tex., October 6-8.

Technical Association of the Pulp and Paper Industry, fall meeting on alkaline pulping and chemical products, Asheville, N. C., October 9-11.

Electrochemical Society, fall congress, Copley-Plaza Hotel, Boston, Mass., October 15-18.

National Lubricating Grease Institute, annual convention, Edgewater Beach Hotel, Chicago, Ill., October 16-18.

American Welding Society, annual meeting, Hotel Sherman, Chicago, Ill., October 19-24.

American Society for Metals, National Metal Exposition, International Amphitheater, Chicago, Ill., October 18-24.

Pacific chemical exposition, Civic Auditorium, San Francisco, Calif., October 21-25.

American Institute of Chemical Engineers, annual meeting, Detroit, Mich., November 9-12.

Exposition of Chemical Industries, 21st exposition, Grand Central Palace, New York, N. Y., December 1-6.

American Society of Heating & Ventilating Engineers, eighth international heating and ventilating exposition, Grand Central Palace, New York, February 2-6, 1948

WHEN LARD COMES OVER THE MOUNTAINS

Here's the inside story—Some of America's most particular people protect every load of lard that travels in a GATX tank car.

Shippers—smart and careful—order a car for lard. They say, "Clean it thoroughly. Rub the walls down with lard before loading to avoid contamination from rust."

Eagle Eyes—*the U.S. inspectors*—look over every inch of the car. Then they write, "O.K. for loading" on the release.

. . . So, thousands and thousands of GATX cars are serviced each year for safe bulk transportation of a perishable food.

. . . This is typical of the work done for the railroads and shippers who use the GATX fleet of more than 37,000 specialized tank cars of 207 types.

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√ Never obsolete—can be moved, reassembled and used anywhere.

Catalog No. 46 tells the whole story. Write

T. SHRIVER & COMPANY, INC.

802 Hamilton St. Harrison, N. J.

Wax division of the Petrolite Corp., Ltd., has completed this new propane deasphalting unit at Kilgore, Tex. The unit, licensed by M. W. Kellog Co., was constructed by Koch Engineering Co., Wichita, Kan.

plant has been constructed with sufficient capacity to meet the requiremens of the 84-acre layout.

The fourteen buildings at the plant also contain refrigeration, compression and drying facilities, glass lined reactors suitable for chlorination, amination, nitration and esterification, and lead-lined units for sulfation. There are research and control laboratories, hospital, photographic and blueprint departments, machine shops, carpenter shops, garage, and warehouses.

Allied Again Offers Graduate Engineering Fellowships

THE Allied Chemical & Dye Corp. is offering 27 graduate fellowships, mainly in chemistry and chemical engineering, in 22 universities and institutes of technology for the school year 1947-48. These fellowships are granted with the view to encouraging graduate study and increasing the number of research workers with advanced training. The recipients of the fellowships are selected by the schools. Each fellowship provides a stipend of $1,200 and tuition.

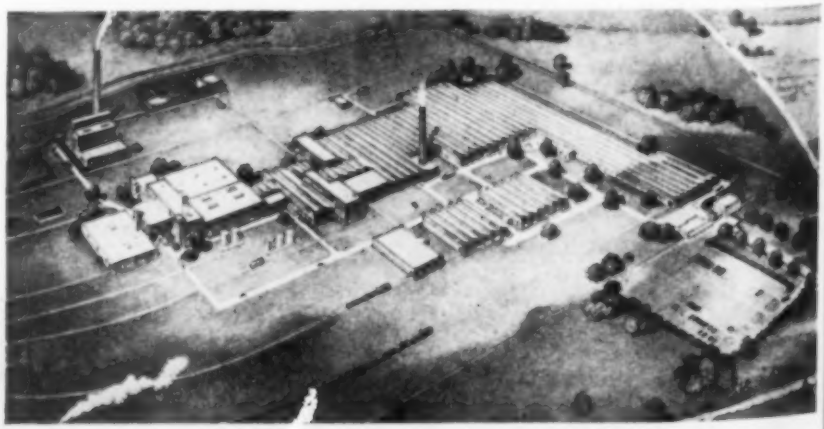
The universities and institutes of technology at which the fellowships are offered are: University of California, California Institute of Technology, Carnegie Institute of Technology, Columbia University, Cornell University, Duke University, Harvard University, University of Illinois, University of Iowa, McGill University, Massachusetts Institute of Technology, University of Michigan, University of Minnesota, Northwestern University, Ohio State University, Pennsylvania State College, University of Pennsylvania, Polytechnic Institute of Brooklyn, Princeton University, Purdue University, University of Wisconsin and Yale.

Cycling Plant Operations Start At Lake St. John

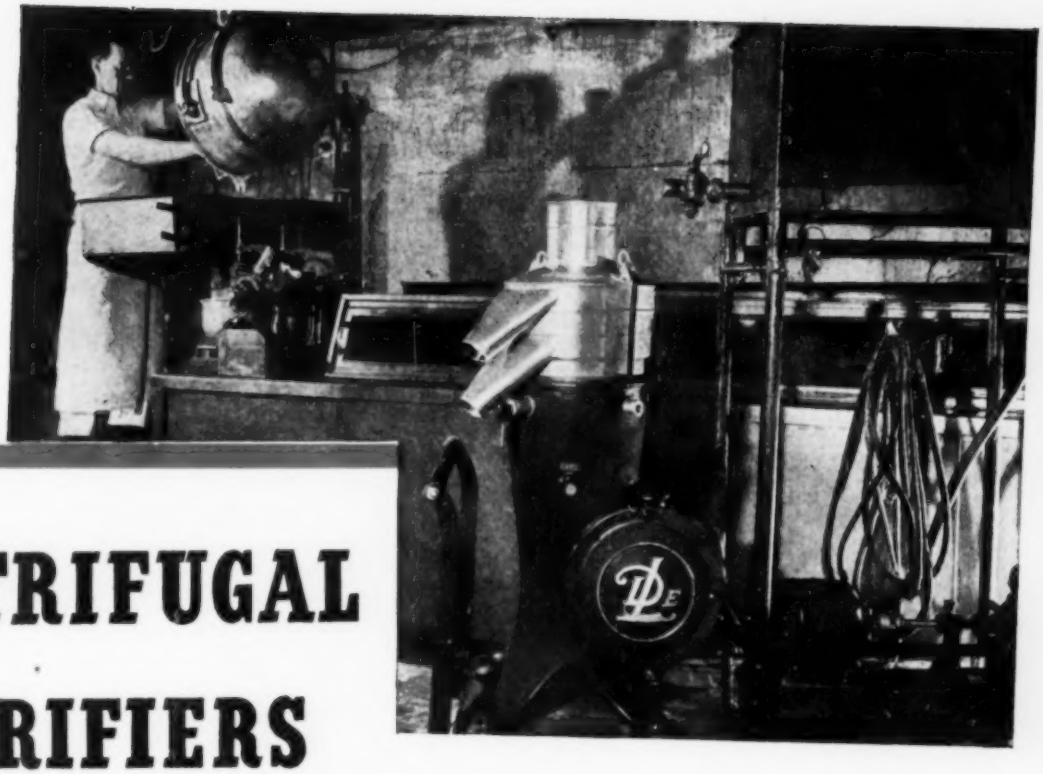
CYCLING operations in Louisiana's first completely unitized gas condensate oil field were inaugurated July 19, at Lake St. John in Tensas and Concordia parishes.

The entire project has been unitized and designed so that all field products are handled through the pressure maintenance and natural gasoline plant, which comprises the cycling process. The products include crude oil, condensate, butane and propane.

Unitization plans previously have been applied to oil production and to gas cycling, but Lake St. John provides the first effort at unitizing both activities in a single project. Under the unitization procedure each operator and royalty owner receives a share



American Enka Corp. is building this new rayon yarn plant at Lowland, Tenn. The $25 million plant is being designed, built and equipped by H. K. Ferguson Co. It will produce 20 million pounds of rayon tire yarn annually and has provisions for the addition of two million pounds of rayon textile yarn



CENTRIFUGAL CLARIFIERS

save $110 per week!

DE LAVAL Multiple Clarifiers save a famous California doughnut maker $110 per week. Small particles of doughnut get into the deep fat frying oil, and, if not removed, get burned to a crisp in the hot oil. Such burned particles, in a week's time, would change cooking oil from clear yellow to black. Moreover—and most important—the oil would become rancid after a time. De Laval Multiple Clarifiers make it possible to use the cooking oil indefinitely by making it so clean it can be added directly to the make-up oil.

This is another specific instance of how De Laval centrifugal machines can save money by effecting continuous separation. This particular clarification is fairly simple, but often the application is for a more difficult type of separation. In all such cases, a wide range of types and sizes of De Laval machines is available to help you do the job quicker . . . more completely . . . ***continuously.***

Write for Bulletin IC-1.

THE DE LAVAL SEPARATOR COMPANY
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One hundred and ninety-five manufacturers' catalogs—1,520 catalog pages—instantly accessible in the 1948 Sweet's File for the Process Industries. There, right in your office, you will find up-to-date, useful and comprehensive information on forms, characteristics, performance and use of a wide range of materials, equipments and services.

Manufacturers' catalogs in Sweet's File are indexed by company name, by product and by trade name, so that you can find the information you want instantly—whenever you need it . . . . . SAVE TIME—SAVE TROUBLE LOOK IT UP IN SWEET'S

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of the production from the entire field in proportion to the value of recoverable reserves under his tract.

The Lake St. John field was discovered by The California Co., a Standard of California subsidiary, in 1942. The $4,500,000 cycling project was designed to operate at a pressure of 1600 lb. per sq. in. and to inject gas at 4,000 lb. per sq. in. Construction was started in 1946 and completed this summer.

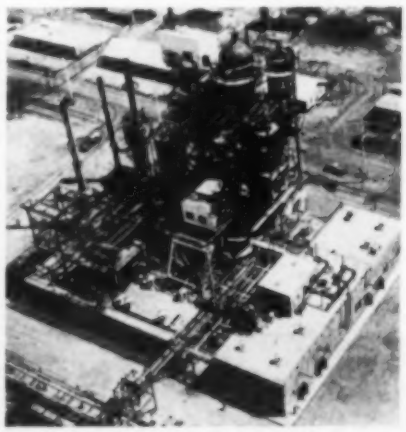
Under the Lake St. John unitization formula approved by the Louisiana conservation department, The California Co. has a participating interest of approximately 75 percent. The Carter Oil Co. has about 21 percent. The remaining 4 percent is controlled by various companies and individuals.

WAA Sells Houston Aviation Gasoline Plant

SALE of the government-owned $10,300,000 aviation gasoline plant at Houston, Tex., to the war-time lessee, Eastern States Petroleum Co., for $2,000,000 has been announced by War Assets Administration. Situated near the company's refinery, the plant includes a fluid catalytic cracking unit, HF alkylation unit and equipment for catalytic isomerization of butane.

Koppers Breaks Ground for New Units at Kobuta

ON August 1, Koppers Co., Inc., broke ground at Kobuta, Pa., for construction of new polystyrene and ethylene facilities. Work on the new facilities, to be built by the Koppers engineering and construction division, a portion of them probably will be in operation by next March 1. Polystyrene is now being made on a pilot plant basis at Kobuta, is an important plastic material much in demand because of its wide adaptations to industrial use. Ethylene is a basic ingredient in the making of styrene monomer, the material from which polystyrene is made. Mr. Rugg told the board of directors that Koppers will have a productive capacity of approximately 20 million pounds of polystyrene per year after the new facilities are completed.



This new Texas Co. Fluid Catalytic-Cracking unit at the Caspar, Wyo., refinery embodies new design improvements. It has a capacity of 10,000 bbl. per day

Specially equipped to carry bulk liquefied petroleum gas, this Standard Oil Co. (New Jersey) tanker sailed from Wilmington in July with a cargo of 100,000 gal. of propane. Consigned to Companhia Nacional de Gas "Esso," Rio de Janeiro, a joint Brazilian-Standard Oil Co. (New Jersey) enterprise. Later the tanker will operate between Aruba and Brazilian ports

Shell Hexylene Glycol Plant Under Construction in Texas

SHELL CHEMICAL CORP. announces that a plant for the manufacture of hexylene glycol is under construction at Houston, Texas. Production is expected to begin on a full scale early in 1948. M. W. Kellogg Co., New York City, is in charge of construction.

B. M. Downey, manager of the company's Houston plant, points out that investigations of hexylene glycol are being made to determine its value as a component of soluble oils, engine cleaners, prespotting soaps, and grinding aids and adhesives. Principal present uses of the chemicals are in the manufacture of hydraulic brake fluids, printings inks and as a coupling agent or penetrant in textile work.

Joint High Vacuum Symposium Scheduled for October

NATIONAL RESEARCH CORP., in cooperation with the ACS, has announced plans for a High Vacuum Symposium to be held this fall in the Hotel Commander, Cambridge, Mass., October 30 and 31. Attendance will be

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Fire insurance is always essential. It goes far to replace property damage and lost earnings . . . but no insurance policy can return destroyed records — restore lost customers — replace trained employees.

For more than a half century "Automatic" Sprinkler has served industry — the Federal Government — institutions — commercial and industrial undertakings of all kinds. Fire protection problems of all types have been met. Engineering, occupational and financial difficulties have been overcome. Instinctively, thousands of well satisfied customers call upon "Automatic" Sprinkler time and again for assistance in the solution of new fire hazard problems.

What is your problem? Let us try to help you. Our entire organization is at your service to give the utmost in "Automatic" Sprinkler fire protection. "Automatic" Sprinkler Corporation of America, Youngstown 1, Ohio.

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IMPREGNATED FILTER FABRICS

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- Mildew and rot resistant
- Frequently outlast untreated fabrics three to one
- Maintains filtering capacity
- Smooth surface
- Cakes come away easily
- Reduce gumming
- Fewer washings required
- Less shrinkage on press
- Non-capillary
- Better filtration
- Soft, flexible—sews easily

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Send us, prepaid, a roll of your cloth for finishing. Try it under actual plant operation.

Information and Samples on request

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LODI, NEW JERSEY

The Pacific Chemical Exposition Committee meets with Exposition Manager and Chairman for final plans for the October 21 to 25 show at San Francisco's Civic Auditorium where the Pacific Chemical Exposition will run concurrently with the Pacific Industrial Conferences. Left to right standing: Donald W. Baldra, Sterling L. Redman, Walter B. Peterson and Merle Randall. Seated left to right: Leo R. Gardner, Richard Wistar, Marcus W. Hinson, Exposition Manager; Paul H. Williams, Chairman, Exposition Committee; Theodore K. Cleveland, Fred D. Tuemmler, George L. Parkhurst and John R. Matchett. Other committee members are Robert Matteson, chairman of the California Section, American Chemical Society and T. Dale Stewart, James Clayton, J. E. Hedrick, Bradford P. Geyer and W. J O'Connell, Jr.

restricted to technical and scientific personnel concerned with industrial applications of high vacuum. Invitations will be issued on recommendations of the various Symposium division heads, with particular effort being made to promote discussion of low pressure applications in the process industries. The following subjects will be discussed: Scientific Aspects of High Vacuum, High Vacuum Engineering, Vacuum Distillation, Vacuum Metallurgy, and Vacuum Dehydration.

Lever Brothers Erecting Baltimore Solexol Unit

THE SOLEXOL process will be operated for the first time commercially at the Baltimore Plant of Lever Bros. Co. The new unit, a tallow fractionating plant, with a capacity of several hundred thousands pounds per day, is one of the largest such plants to be installed by a soap company. This plant will provide base tallow for many millions of units of soap products per year.

Construction of the new unit has been under way ten months and it will be completed early in October. Design and construction is by the M. W. Kellog Co.

Shell Opens Administrative Offices in New Orleans

OPENING of a new administrative area with headquarters in New Orleans has been announced by Shell Oil Co. Shell says the move was made in order to 'keep pace with expansion in exploration and production and related activities of the company." The New Orleans office is in the Richards Bldg., plus additional space in the Maritime Bldg. Area Manager is E. G. Robinson, who is responsible for operations in Louisiana, Arkansas, Mississippi, Alabama and other southeastern states.

Associated with Robinson are F. W. Oudit, former geophysicist in Houston, who has become exploration manager; E. N. Van Duzee, formerly division manager at Lake Charles, La., who will be in charge of production in the new area; and W. M. Johnson, who will manage the land department.

Monsanto Increases its Detergent Production

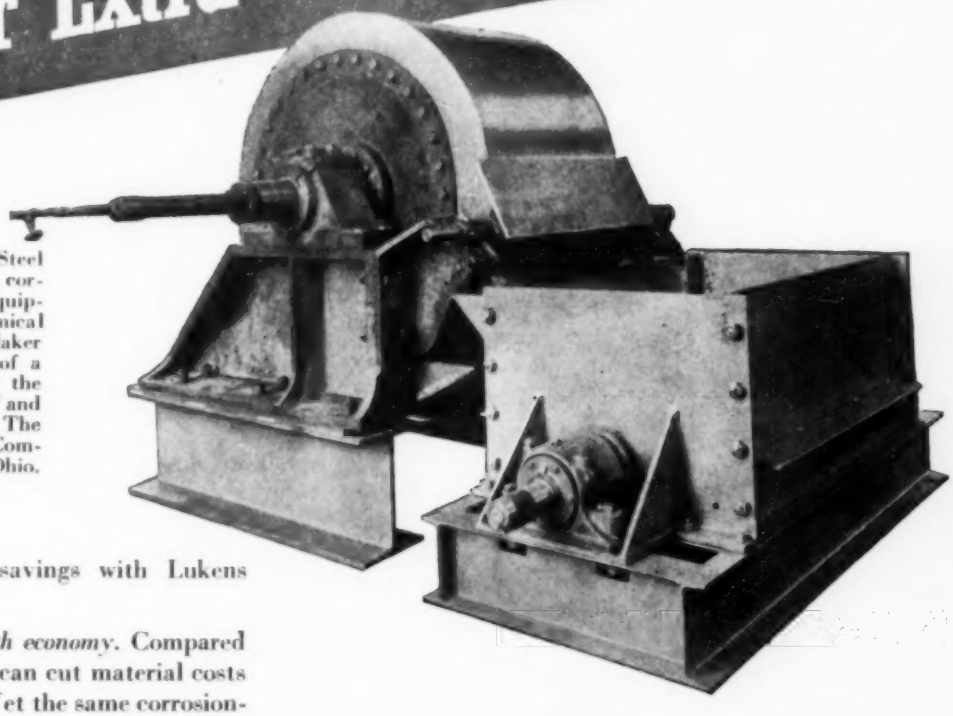
OUTPUT of synthetic detergents was considerably increased when Monsanto Chemical Co's. $3 million plant at Monsanto, Ill. was completed in August. The new plant supplements Monsanto's existing detergent production at Nitro, West Virginia.

Eastman Kodak Fellowships Offered for 1947-48

SIXTEEN educational institutions have been offered one or more of 22 Eastman Kodak Fellowships in chemistry, physics, engineering, and business administration for the school year 1947-48. In addition six similar Fellowships are to be sponsored by Tennessee Eastman Corp. Twelve of the Kodak awards are for doctoral work, each valued at $1,200. One in physics and one in chemical engineering will go to Massachusetts Institute of Tech-

Stainless-Clad for Protection

Wide for Extra Savings



A 10% Lukens Clad Steel was used to resist corrosion in this flaking equipment for a large chemical manufacturer. The flaker pan was fabricated of a 5/8" Clad Steel and the breaker hopper of 1/2" and 1/4" Clad Steel, by The Colonial Iron Works Company, Cleveland, Ohio.

You make *two* big savings with Lukens Stainless-Clad Steels—

1. *PROTECTION with economy.* Compared with solid stainless, you can cut material costs as much as 50 per cent. Yet the same corrosion-resistant face is provided, to protect both equipment and products. Heat transfer efficiency is far superior to solid stainless—approaching that of the backing plate, itself.

The stainless may be of any standard type. It is permanently bonded in a *uniform* thickness to any quality of carbon or low alloy steel —from 5 to 50 per cent of total plate thickness.

2. *FABRICATION with economy.* The widest plate you can use is the cheapest! Less welding footage cuts costs and shortens fabrication time. You can get Lukens Stainless-Clad Steels in plates *up to 178" wide*, or from 3/16" to over 3" thick.

Save with Standard CLAD HEADS

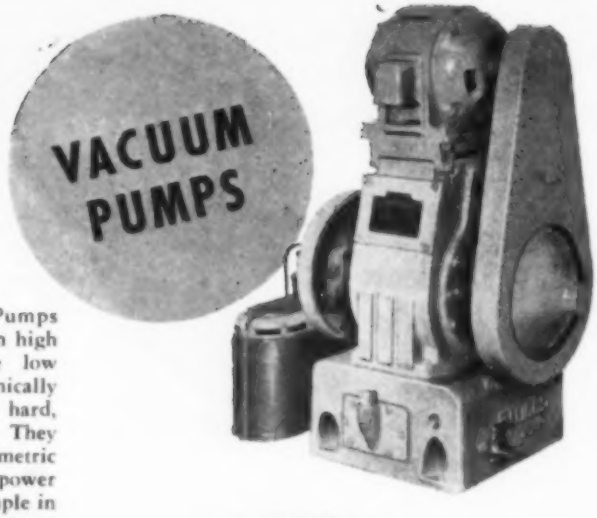
Spun or pressed, in all standard types and sizes to over 18' in diameter. Write for Bulletin 384. Further information on Lukens Stainless-Clad Steels, Bulletin 338; on Nickel-Clad, Inconel-Clad and Monel-Clad Steels in Bulletin 255. Lukens Steel Company, 400 Lukens Bldg., Coatesville, Pa.

CLAD METAL STEEL

LUKENS

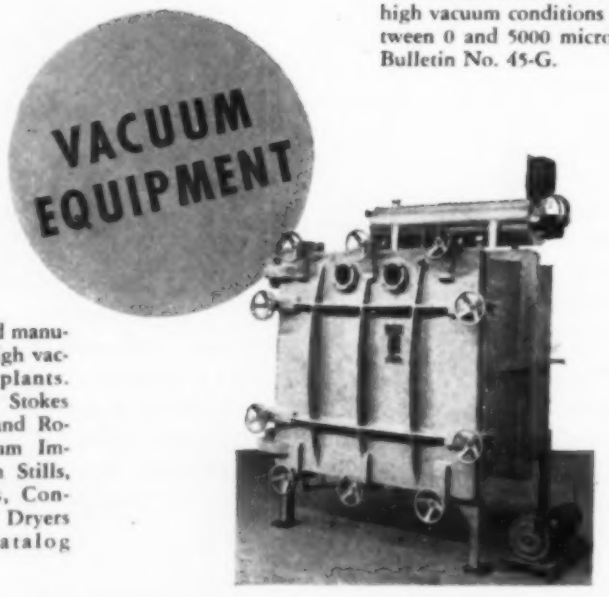
Nickel-Clad Stainless-Clad
Inconel-Clad Monel-Clad
STEELS

SOLID METAL ADVANTAGES WITH CLAD STEEL ECONOMY



Stokes Microvac Pumps produce and maintain high vacuum within the low micron range, economically and dependably in hard, continuous service. They combine high volumetric efficiency and low power requirements; are simple in design, rugged in construction, fool-proof in operation. Six models, 10 to 500 cu. ft. displacement. Bulletin No. 463.

Stokes High Vacuum Gages (patented McLeod type) are always accurate, even in the presence of condensable vapors. Require no calibration, give rapid readings, are easy to operate—just tip and read. New "Vacorder" gage produces a continual, visible record of high vacuum conditions between 0 and 5000 microns. Bulletin No. 45-G.



Stokes engineers and manufactures complete high vacuum processing plants. Widely used are Stokes Vacuum Rotating and Rotary Dryers, Vacuum Impregnators, Vacuum Stills, Pans, Evaporators, Condensers and Shelf Dryers (illustrated). Catalog No. 46-C.

F. J. STOKES MACHINE COMPANY
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FJS Est. 1895

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...TECHNIQUE AND EQUIPMENT

nology. One each will go: in physical chemistry to Columbia, Rochester, and Yale Universities; in organic chemistry to Harvard, Illinois, Nebraska, and Notre Dame; in physics to California Institute of Technology, and the universities of Michigan and Wisconsin. Ten are for master's work. Each is worth $750 and the two in chemical engineering go to Michigan and Cornell.

Westvaco Uncovers New Natural Ash Source

SEVERAL million tons of sodium sesquicarbonate at Rock Springs, Wyoming, are being tapped by Westvaco Chlorine Products Corp. as a source of natural soda ash. The 10 ft. bed is 1,500 ft. below the surface, and will be mined by the company. Pilot plant operations will begin in October.

John C. Carrington
Elected Assistant to the President, Freeport Sulphur Co.

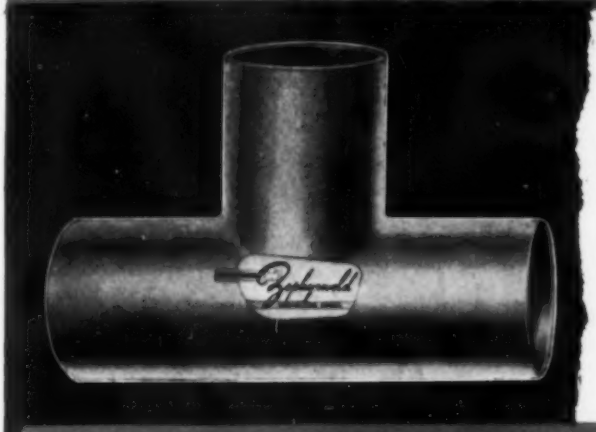
Kanotex to Modernize its Arkansas City Refinery

KANOTEX Refining Co. has completed arrangements for modernizing its Arkansas City refinery, according to F. A. Deering, general superintendent of refining. The program includes a Perco catalytic desulfurization-catalytic reforming unit, licensed by Phillips Petroleum Co., revamping and enlargement of vapor recovery and catalytic polymerization facilities. Koch Engineering Co., Wichita, Kansas has contracted for the engineering and construction work.

Trade Publication Articles To Receive IFMA Awards

The Industrial Furnace Manufacturers Association, Inc., 420 Lexington Ave., New York 17, N. Y., desires to promote the publication of more and better technical articles in trade publi-

TRI-CLOVER OFFERS 3 DEPENDABLE



Zephyrweld WELDING FITTINGS

. . . in sizes from 1" thru 18" O. D., fabricated in gauges from 16 to 10, for use with stainless steel light gauge O.D. tubing, under broad corrosive conditions requiring semi-permanent or permanent welded line installation . . . available in a complete line of ells, tees, crosses, adapters, etc., in stainless steel types 304, 316, 347.

STAINLESS STEEL FITTING TYPES . . .

FLANGED TYPE Conical End FITTINGS

. . . fabricated from stainless steel type 316 for use with commercial tolerance light gauge tubing having outside diameters from 1" thru 10." Easily assembled with light weight, high strength couplings, which provide an extremely compact, flush, leak-tight union for working pressures up to 250 psi. Complete line of ells, tees, crosses, adapters, etc.

FOR CORROSION-RESISTANT CONVEYING LINES

THE WALLACE PIPE UNION*

. . . . fabricated from stainless steel type 316, permits the use of thin wall stainless steel tubing in connection with standard threaded iron pipe size fittings of all kinds . . . saving from 25% to 45% in material without any loss of effectiveness.

*Patent No. 1953665

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All 3 types of TRI-CLOVER fittings are fully described and illustrated in individual catalogs, just off the press. Send for your copies today, mentioning in which of the types you are interested.

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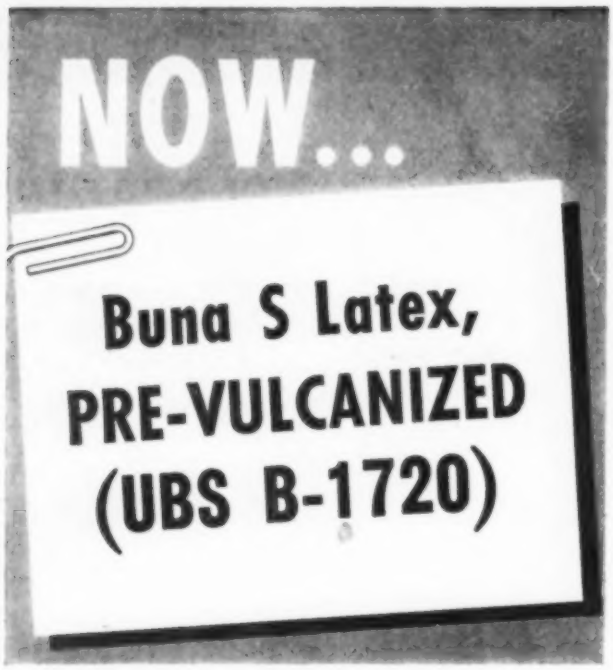
TRIALLOY AND STAINLESS STEEL SANITARY FITTINGS, VALVES, PUMPS, TUBING, SPECIALTIES

FABRICATED STAINLESS STEEL INDUSTRIAL FITTINGS AND INDUSTRIAL PUMPS

THE Complete LINE



. . . 2500 lbs. tensile strength minimum
. . . dry, non-tacky film
. . . no adding of vulcanizing agents . . . no heat treatment necessary other than drying

PROPERTIES

1. Dried film tensile strength.....2500 lbs. per sq. in. minimum
2. Dried film ultimate elongation....700% to 800%
3. Viscosity .....Thin
4. Specific gravity.....1.025
5. pH Value.....9.8 to 10.2
6. Solids content.....53%

APPLICATION

1. Back coating of rugs and fabrics to impart non-slip and fibre binding characteristics.
2. Coating and impregnating of fabric, paper and wadding for strength, water resistance, and base for further coating.
3. Preparation of molds utilizing properties of flexibility and freedom from further heat treatments.
4. Dipped goods where deposition of film is complete on drying.
5. Adhesive for paper, fabric and leather where bond is improved by film deposit of cured Buna S.
6. As an additive to natural latex, as well as to buna and neoprene, for extension and modification.

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cations describing the economic advantages obtained by the use of modern industrial furnaces, kilns, and ovens. To this end, IFMA will award prizes amounting to $1,500 to the authors of the three best articles which are published in trade publications between October 1, 1947, and September 30, 1948, inclusive.

New ACS Section Formed At Worcester

A CHARTER has been granted to form a central Massachusetts section of the American Chemical Society, with John R. Erickson of the Norton Co., Worcester, as chairman. Other officers are Dr. Andrew Van Hook and Dr. O. L. Beril of Holy Cross College, respectively secretary and treasurer; Dr. Ernest D. Wilson, Worcester Polytechnic Institute and Roy C. Charron, United States Envelope Co., national council representatives. Besides the fore-going the executive committee includes Rev. Bernard A. Fiekers, Holy Cross College; Y. H. Nordstrom, Norton Co.; and Harry B. Feldman, Worcester Polytechnic Institute.

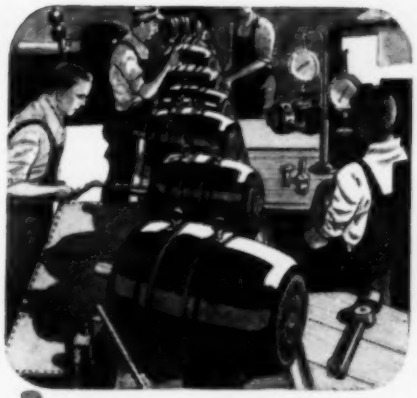
Chattanooga ACS Section to Observe its Tenth Year

TENTH anniversary of the Chattanooga Section, American Chemical Society will be suitably observed on October 10-11, with a "Meeting in Minature." This two-day meeting will be held in Chattanooga with the University as headquarters, and Dr. J. W. Lemaistre is serving as general chairman in charge of arrangements. There will be fifteen general papers presented and a symposium on the advanced use

Arco Co. research laboratory, recently completed, adjacent to the company general offices in Cleveland, has complete facilities for a research program devoted to the development of new synthetic resins and other basic raw materials; improved protective coatings, and product evaluation work

1 1561—Crude, manually-operated bellows were used in an attempt to pump fresh air into a mine, but with indifferent results, according to a journal published in Switzerland. And man's quest for comfort indoors was under way.

2 1890—This age-old method of keeping cool was still in use in many parts of the world. But in this era electric motors came into general use. Soon to come were new ways to make air work for man's comfort and well-being.



3 1915—The Howell Red Band Motor made its appearance. Seven years later the first movie theater was fully air conditioned. Other businesses followed. Air conditioning was on its way, thanks to the electric motor as a source of power.

Then, Air Conditioning arrived!

4 Today it's different! And better!

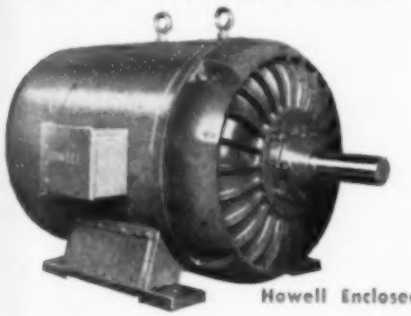
Air is universally used for comfort . . . for profit. It's the exceptional business that does not put air to work.

In the air conditioning and allied industries, you'll find Howell Motors driving fans, blowers, exhausters, air washers, compressors and conditioning equipment, as well as pumps, heating, drying and cooling apparatus. And you'll find every user has a good word for Howell!

Why? Because Howell Motors are industrial type motors designed for the toughest applications in industry. Consequently, they perform better on all jobs.

Are you using them?

Here's another precision-built Howell Motor. Howell Motors are industrial type with copper or bronze rotors—specially insulated — statically and dynamically balanced. Be sure you specify Howells!



Howell Enclosed, Fan-Cooled Motors—Type K

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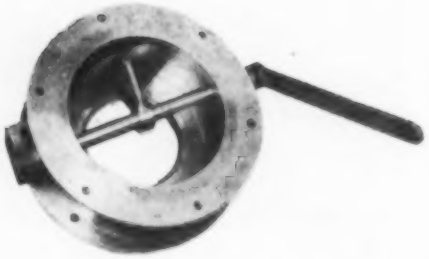
HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Manufacturers of Quality Industrial Type Motors Since 1915

"GEMCO" SPHERICAL VALVES.



Advantages over other valves:

Valve action is superior.* Dust tite* Cannot stick because spherical action disc cuts thru materials and scrapes the seat clean as it closes. Differs radically from slide gate which sticks and causes material to sift out * * "GEMCO" Spherical Valve is a non-sifting and non-sticking watertight closure. Easy operating * * a quarter turn closes the largest or smallest valve POSITIVELY. Enables operator, where necessary, to measure definite quantities (by placing container on scales and opening valve to measure predetermined amount of material accurately) with the aid of this quick closing device. The valve is long lasting and trouble free as experienced by present users, among which are many prominent firms.

Practical Uses:

To replace slide gate wherever one is used, for handling dry and pasty substances.

For pipe lines or hopper installations.

Construction and sizes:

Expertly engineered and machined for easy, positive closing and seating, in sizes ranging from six to fourteen inch openings. Construction in metals and alloys to meet service requirements such as cast iron, monel metal, stainless steel, aluminum, copper and bronze. Bronze seat and disc can be specified where danger of fire or explosion exists * * spark proof.

THE "GEMCO" SPHERICAL VALVE is in service by many prominent concerns and is applicable to colors, chemicals, fertilizers, foods, pharmaceuticals, soaps, inks, plastics, grains or wherever dry granular or pasty substances are moved thru pipe lines or hopper installations.

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If you use or Distribute PRESSURE REDUCING VALVES *For*

- AIR LINES
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Consider CASH-ACME's continued acceptance by the nation's largest manufacturers and jobbers during the past twenty-five years, as indicative of their satisfactory performance.

See your Mill Supply dealer—ask for CASH-ACME Automatic Valves.

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Manufacturing SPECIALISTS OF CASH-ACME *Automatic* PRESSURE CONTROL VALVES

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DECATUR ILLINOIS

of chemistry and electricity in industry. The theme of the meeting will be expressed in the term CHEMICITY, coined to combine the two subjects, chemistry and electricity, and indicate their close association in the development of industry. Since this date also represents the second anniversary of the Industrial Research Institute of the University of Chattanooga, open house will be observed by the Institute for the duration of the meeting.

William W. Knight, Jr.
General Manager of Plaskon Division, Libby-Owens-Ford Glass Co.

Ethyl Corp. Makes Shea New President

EDWARD L. SHEA has been named president of the Ethyl Corp. to succeed Earle W. Webb, who becomes chairman of the board. He is former president of Tide Water Oil Co. executive vice president of Tide Water Associated Oil Co. and a director of the American Petroleum Institute.

Textile Institute Receives Building Grant

THE Institute of Textile Technology at Charlottesville, Va., has been given a $50,000 contribution from Callaway Institute, Inc., LaGrange, Georgia, for the purpose of building and equipping a seminar or auditorium building dedicated to Stuart W. Cramer. A contribution of $20,000 from Callaway Mills, LaGrange, has been designated for use in the same project.

Citcon Corp. Formed to Run Lake Charles Plant

ORGANIZATION of a new company, the Citcon Corp., to operate a $30 million plant for the manufacture of salvent refined lubricating oils near Lake Charles, La., has been an-

Power Engineers Agree: It's the GUTS that make a GOOD BOILER

STEAMASTER Builds Boilers with PLENTY of GUTS!

In design, construction and materials, Steamaster builds boilers with the guts to give reliable, efficient performance year in and year out.

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The GUTS of the Steamaster Boiler

Water Tube Design

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Sectional Steel Headers

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In every industry where high pressure boilers are used you will find Steamaster Automatic Boilers giving consistently excellent performance at low cost.

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Quick Facts About the Advantages of the STEAMASTER Water Tube Boiler:

- **All Steel Construction.**
- **Positive Tidal Circulation of Water**—maintains all parts at equal temperature.
- **Condensate Return System Built-in** as an integral part of all boilers of 60 h.p. and up.
- **Fabricated Entirely in Our Own Plant.**
- **Easy Inspection and Maintenance**—every tube immediately accessible. Just open the heavily insulated access doors.
- **Large Combustion Area . . . Three-Pass Heat Baffling** gives high thermal efficiency.
- **Choice of Fuel — Gas, Oil or Coal** or any combination of these fuels to meet fuel requirements of your plant.
- **Fully Equipped for Automatic Operation**—with the finest accessories. As nearly automatic as a boiler can be.
- **A.S.M.E. CODE — National Board Approved.** Inspected and certified by Hartford Steam Boiler Inspection and Insurance Co.
- **Full Range of Sizes** from 10 h.p. to 300 h.p. as illustrated. The Model A for 3½ h.p., 5 h.p. and 7½ h.p.
- **Can Be Fired Over Rated Capacity** and still maintain high thermal efficiency.

Power Engineers Agree: STEAMASTER is the Boiler with PLENTY OF GUTS!

SPRAY TROUBLE? Consult MONARCH

Fig. 631

Are all of your processes using Spray Nozzles as efficient as you think they could be? Do the Sprays distribute the liquid evenly? Break it up into as fine particles as you would like? Resist the corrosion or wear conditions satisfactorily?

Send Monarch an outline of any spray problem—if your liquid can be sprayed with direct pressure at all—Monarch can furnish the nozzles.

NOZZLES FOR:

- ACID CHAMBERS
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- GAS SCRUBBING
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- OIL BURNERS
- SPRAY DRYING

Do you have our Catalogs 6A and 6C?

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This Jefferson Chemical Co. plant is nearing completion at Port Neches, Tex. The plant will produce ethylene glycol and ethylene oxide.

nounced in Tulsa, Okla. Organizers are Cities Service Co. and Continental Oil Co. Capacity of the plant is reported to be 6,000 bbl. per day of lubricants plus bright stock, neutrals and waxes. Contracts have been let to Max B. Miller Co. and the Lummus Co., both of New York City.

Industry Briefs

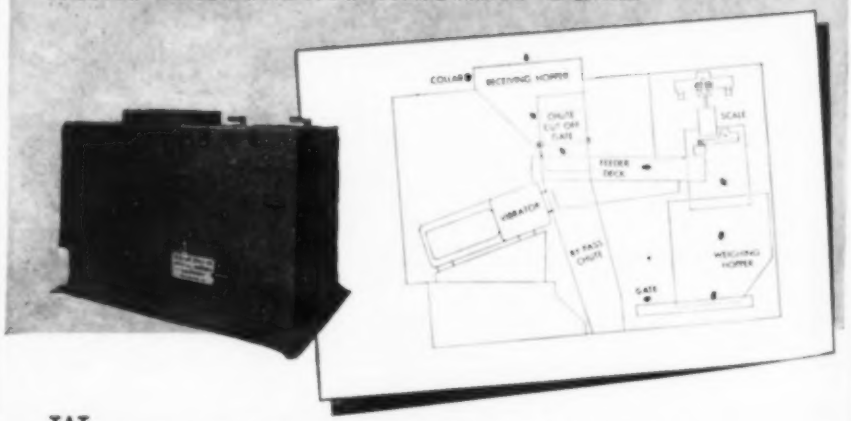
Tung oil extraction plant of the Florala Nut Oil Co., Florala, Ala., was destroyed by fire of undetermined origin July 21. It was the third largest plant of its kind in the world.

Atomic Energy Commission has named Roger S. Warner, Jr., Ipswich, Mass., formerly coordinating engineer for Los Alamos Laboratory, director of engineering.

Honor Scroll of the American Institute of Chemists will be presented to Dr. Ernest H. Volwiler, executive vice president, Abbott Laboratories, on October 10, 1947, for his outstanding work in organizing research programs.

First Made in Georgia exposition will be held in Atlanta at the Municipal Auditorium October 8-12.

No Troublesome Belts . . . IN THE BEAUMONT "VIBRO" AUTOMATIC WEIGHING SCALE



WHY bother with belts, pulleys and motors in weighing scales?

The stainless steel vibrating feeder in the Beaumont "Vibro" Automatic Weighing Scale has no belts or moving parts—eliminates faults. It is particularly well adapted to very abrasive materials and the rate of feed can be easily adjusted by a rheostat controlling the vibration of the feeder.

Other features include: high weighing accuracy, feeder capacity from 1 to 60 tons per hour, dust proof construction, quiet operation and long life. We can promise prompt shipment on standard units. Write for descriptive bulletin.

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UNCHALLENGED QUALITY

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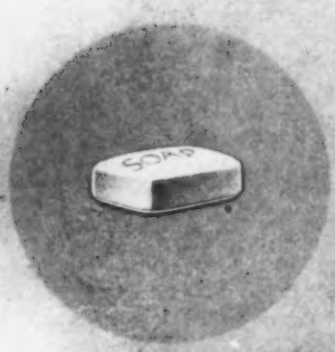

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FOR SOAP MANUFACTURERS

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Caustic Soda

Soda Ash

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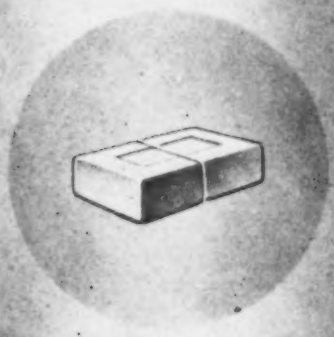

SOLVAY SALES CORPORATION

Alkalies and Chemical Products Manufactured by The Solvay Process Company

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NEWS FROM ABROAD

Special Correspondence

GREAT BRITAIN INCREASED EXPORTS OF CHEMICALS TO UNITED STATES IN FIRST HALF OF THIS YEAR

MEASURES adopted by the government to meet the threatening economic crisis do not affect Britain's chemical industry directly, but the indirect repercussions will necessitate a number of readjustments. Sales to non-essential trades will suffer if the authorities make use of their labor direction powers, while the demand from essential industries will become more urgent. Shortages of raw materials, and especially coal and steel, should be overcome more easily if the basic industries really receive the concentrated attention which they deserve, but the temporary upsets due to exhaustion of stocks, not only of imported commodities, are likely to grow more frequent and more severe if import programs are revised as seems to be the government's intention. How delicate the stock position is at present was shown clearly by the rapid exhaustion of soda ash supplies after the recent output cut which in turn was due to a short interruption in coal deliveries.

Increased Demand

Despite continued apprehensions regarding fuel prospects for the coming winter, most chemical manufacturers believe increased demands from essential consumers and official encouragement of exports should suffice to make up for any loss of sales in non-essential directions. The labor problem may be eased if the authorities use their powers in favor of chemical works, and the container shortage—which has lately presented a real worry—should be relieved if less important trades reduce their demands. The government's plans are still too vague, and too little is known about details to permit a verdict on their likely success and effects, but the switch from unessential to essential productions and exports should be made easier by the decline in consumer demand, increasingly in evidence of late, which seems to be mainly due to apprehensions about the future and excessive prices for many consumer goods.

Many firms deprived of domestic outlets by curbs on unessential consumption, postponement of housing programs and reduced consumer spending, will try to recoup in the export market. Authorities, however, will hardly repeat the mistake of last year when exports were encouraged indiscriminately. Essential home trades, especially those working for hard-currency markets abroad, will still receive priority, and "unrequited" exports to soft-currency markets will certainly not receive much official support. The distinction now being made between desirable and undesirable exports is reflected by export statistics. In the first half of 1947 chemical exports totalled £30,975,000, compared with £31,695,000 in the first half of 1946—a rise by 178 percent over 1938. Even in volume British chemical exports are far above the prewar rate and the average of British exports in general. The most gratifying feature, from the point of view of the British exporter, was the rise in shipments to the United States—from £604,890 in the first half of 1946 to £1,180,982 in 1947. In South America, Uruguay and Venezuela were the only countries to take more British chemicals, but these gains were more than offset by the fall in shipments to Brazil, Chile and Peru. Canada increased her takings of British chemicals, so dollar earnings of the British chemical industry as a whole show a welcome increase. British overseas countries also received larger quantities of chemicals; shipments rose in particular to India, Ceylon and Malaya and, to a lesser extent, to some African territories such as Southern Rhodesia and West Africa, while the South African Union, Australia and New Zealand slightly reduced their purchases. A very substantial increase occurred this year in chemical exports to China, while in the Middle East, larger shipments to Iran, Iraq and Turkey did not suffice to offset the fall in exports to Egypt, Greece, Palestine and Syria. In Europe Poland, Czechoslovakia, Germany and Switzerland accounted for larger exports, but most other countries, especially France, Italy, Spain, Portugal, Denmark, Finland and the Soviet-Union, received far less than in 1946.

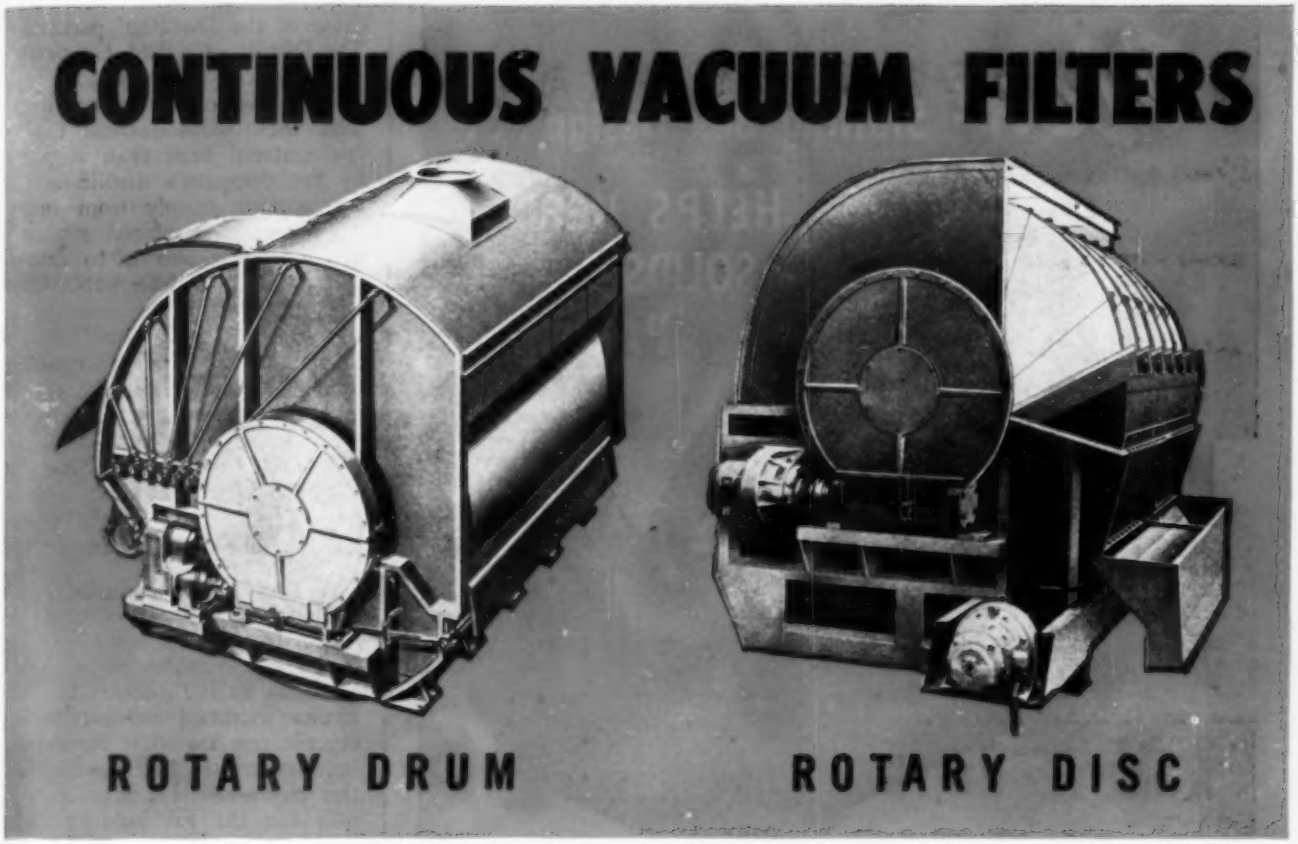
Export Losses

These export losses in Western and Northern Europe leave total chemical shipments to these areas still far above the prewar level, but in view of the disappointing payments in cash and kind received from the countries in question the authorities see no reason to encourage exports in these directions. Recovery in the Far East, on the other hand, has made sufficient progress to allow this area to resume its former prominent place in the British chemical export trade. Figures for the first half of 1947 indicate the future trend. The Dominions, the western hemisphere and the quickly-developing markets of the Far and Middle East will absorb, it is hoped, growing quantities of British chemicals, while most European markets must perforce be neglected while the present currency position prevails.

Expand Oil Refining

A cut in gasoline rations is one of the economy measures imposed by the government, but this will not hold up plans for expansion of the oil refining industry in the British Isles. The Anglo-Iranian Oil Co. intends to follow the lead of the Shell group and enter the chemical field. Together with Distillers Co. Ltd., it will form a new £5,000,000 enterprise to manufacture solvents and other chemicals from petroleum in close association with the Anglo-Iranian's refining operations. The new company presumably will erect a plant near one of the Anglo-Iranian's Scottish refineries, and its range of production is likely to include alcohols. This seems to be the major

CONTINUOUS VACUUM FILTERS



ROTARY DRUM ROTARY DISC

Conkey Rotary Drum and Rotary Disc Vacuum Filters provide design and operating advantages over other continuous filter types.

Conkey design — the result of many years experience in designing, manufacturing and installing filters handling a wide variety of materials—insures dependable and economical filter performance.

Conkey filters in standard construction, and with a basic design sufficiently flexible to permit materials of construction and design adaptation to special process and throughput requirements with a minimum of change, are available in a wide range of standard sizes.

For complete details of these exclusive design and operating features write for Bulletin #102, Conkey Rotary Disc Vacuum Filter and Bulletin #103, Conkey Rotary Drum Vacuum Filter.

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New Stuffing Box Design . . .

HELPS KEEP SOLIDS OUT OF PACKING!

MORRIS

New Type R Slurry Pump

Takes its suction from drive side only!

If the newest Morris Type R Slurry Pump had no other feature but this one . . . it still would be the most outstanding pump on the market.

Since the packing is under suction or positive head pressures only, it is not subject to the high stuffing box pressures typical of conventional pumps. Therefore, it is not vulnerable to severe wear and tear of abrasive solids. Packing troubles are at an absolute minimum. But this is just one of many Morris features which mean . . .

Longer Service With Less Trouble

- **Easily dismantled** — Impeller and shaft sleeve can be renewed without disturbing suction and discharge piping or bearings.
- **Simple in design** — The Morris Slurry Pump has no internal studs and bolts . . . no troublesome joints and fits.
- **Interchangeable shell** — Suction and discharge nozzle can be swiveled to almost any position. Shell changed for either right or left hand rotation.
- **Other features** — The shell is not subject to high stress. Power requirements are surprisingly low. Operates equally well under vacuum or positive head. Can be used as a booster pump.

Easy to install! Easy to dismantle! Easy to maintain!

The Morris Type R is specifically engineered to handle mixtures containing ore concentrates . . . tailings, slag, and residue from filters and classifiers. Operates on all types of caustic or acid mixtures containing abrasives or solids.

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MORRIS *Centrifugal Pumps*

cause of the Distillers' participation. The Distillers Co. Ltd. has developed its industrial solvents and plastics interests over past years, and it would seem these plans demand a broader raw material basis than is provided by the company's distilleries which are working mainly from molasses. According to unofficial reports the new company also is to undertake manufacture of detergents.

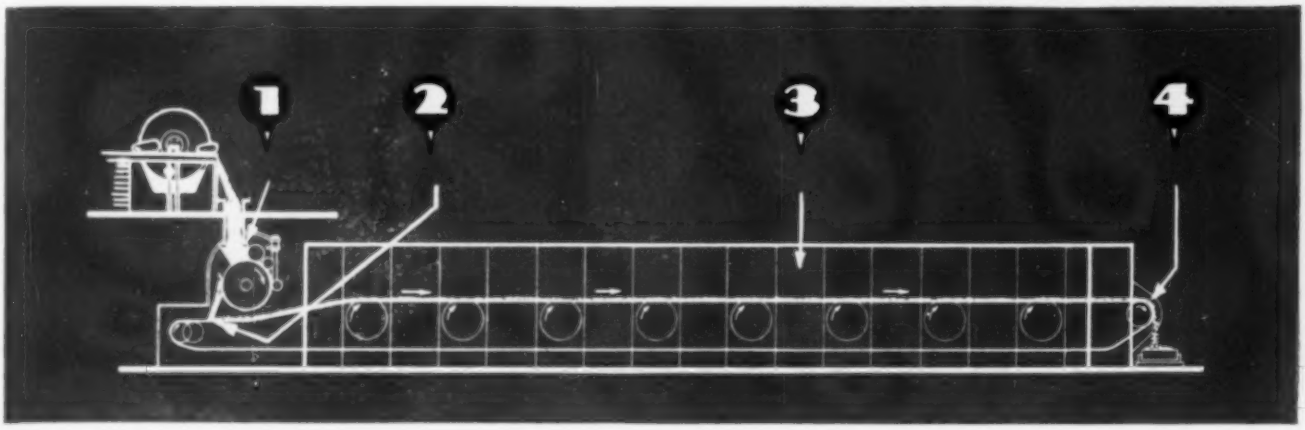
In the meantime Shell is pushing ahead with its ambitious plans in the chemical field. Teepol, a surface active agent based on sodium higher alkyl sulphates, is now being made on a large scale in England, according to an announcement of the Shell Chemicals Ltd.

More Raw Materials

As the chemical industry stands to obtain larger quantities of raw materials from oil refining as a result of the substitution of oil for coal as a fuel, so the industry is likely to receive increased amounts of other organic raw materials from the gas industry which is expanding activities in an effort to save coal. Not only can the gas industry claim it helps to make fuller use of the calorific value of British coal, but gas prices have risen by a fraction only of the increased cost of crude coal—a point likely to receive more consideration when competitive costs matter again. The government is encouraging an extension of existing gasworks and erection of new plants, and nationalization probabilities notwithstanding many gas companies are availing themselves of government assurance that they will not be prejudiced in the event of nationalization. In the long run modernization and expansion of gasworks plants, together with extension of old and construction of new coke-ovens at steel works, will add considerably to the supply of benzol, tar and ammonia.

Greater reliance on home-produced food which forms part of the government's program will increase demand for chemical fertilizers. An important relaxation of control has come into effect with the government's decision to withdraw all restrictions on the purchase and use of potash fertilizers. The supply of superphosphates and compound fertilizers has increased greatly, while that of nitrogenous materials is limited only by the availability of coal and overriding needs of the export trade. Several millions pounds are being spent on new fertilizer plants, and there is reason to believe that further expansion measures will be initiated when present extensions have been completed.

Magnesium carbonate dried from moisture content of 565%* (B.D.W.B.) to 1.0% in 29 minutes



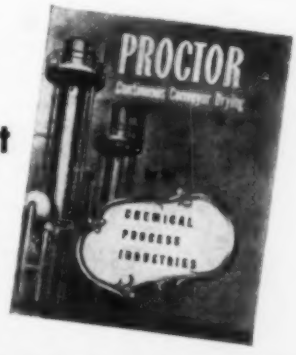
*This means 5.65 lbs of water per 1.0 lb dry material

in PROCTOR CONTINUOUS CONVEYOR SYSTEM

In one typical installation of a Proctor individually designed continuous conveyor system, for use in drying magnesium carbonate, here is what takes place: (1) Material with moisture content of 565% (B.D.W.B.*) is delivered to pre-forming feed of dryer, from a continuous filter (2) Coming to the hopper of the fin drum feed in this highly moist state, the material is pressed into the grooved surface of an internally heated, revolving fin drum. On this drum, the material is dried sufficiently to be discharged to the conveyor of the continuous dryer, in the form of small sticks of uniform thickness. (3) Loaded to uniform depth on the moving conveyor, the material is conveyed through the drying chambers where heated air at 290°F. is circulated *through* the bed of magnesium carbonate. By forming the material into small, uniform shapes, more rapid diffusion is possible, which accounts for rapid drying and uniformity (4) After only 29 minutes of drying time, magnesium carbonate, uniformly dried to a moisture content of 1.0% (B.D.W.B.), is discharged from the dryer at the rate of 500 pounds (C.D.W.†) per hour.

This particular application for one type of Proctor pre-forming feed, combined with a continuous conveyor dryer, illustrates just one installation. These systems are literally tailor-made to meet individual plant and product requirements . after careful research and study into the specific problem. If the drying of wet-solids is part of your operation, it will pay you to have Proctor engineers consider your problem. Write today.

†Commercial dry weight.



This is a case history taken from this new Proctor booklet

A new 12-page booklet on "Proctor Continuous Drying for the Chemical Process Industries" is available upon request. It contains many case studies showing the application for Proctor individually designed systems. Write for your copy of this informative booklet today.

PROCTOR & SCHWARTZ, INC. Philadelphia 20, Pa.

The New
XACTLINE
STRAIGHT LINE
TEMPERATURE CONTROL
For Use With
Pyrometer Controllers

Anticipates
Temperature Change
Eliminates Overshoot
and Undershoot

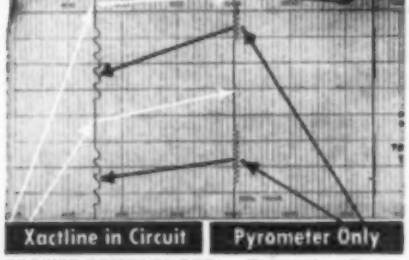
Now with XACTLINE Straight Line Temperature Control you can increase the efficiency of your Pyrometer Control Instruments (either Millivoltmeter or Potentiometer Type) to an amazing degree. Now you can hold tolerances as close as 1/5°F. plus or minus and power "on-off" cycles as low as 3 seconds.

For XACTLINE, operating in the thermocouple circuit, ANTICIPATES the most minute heat variations on both heating and cooling cycles, thereby enabling your pyrometer controller to control far more closely than otherwise possible.

This *Anticipation Factor* means that XACTLINE causes the conventional pyrometer controller to respond to a millivoltage impulse up to 90% less than that normally required, (the controlling pyrometer functions *only* when the desired temperature range has *already been exceeded*).

XACTLINE is laboratory tested and adjusted . . . does not require readjustment or coordination with other controllers.

NO gears, cams, shafts, bearings or other rotating or sliding parts. Simple design eliminates usual maintenance and repair.



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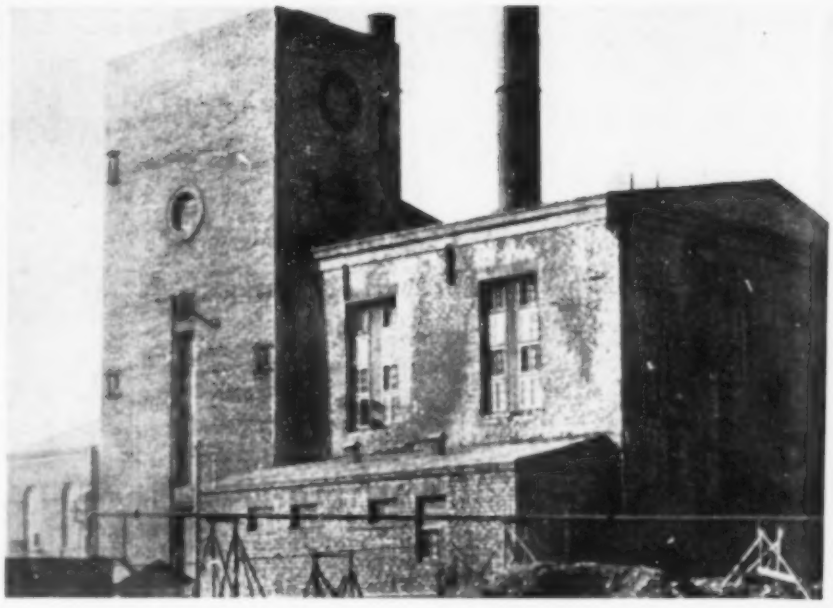

Section of shale refining plant in operation in Kiviili, Virusski County, Estonia

Estonia Is Developing Shale-Oil Resources

REVAMPING of what is probably destined to become the world's biggest oil-shale mining and refining project has begun in Soviet Estonia, whose deposits of high-grade combustible shales are estimated at some five or six billion tons, extending over all of northeastern Estonia.

Mining of these deposits presents no special difficulties, since a substantial part lies close to the surface. The rest, the major part of the deposits, extends to depths not exceeding 35 to 50 feet.

The Estonian shale industry suffered heavy damage, as a result of the war and German occupation. The mines were demolished and flooded, and all power plants blown up. Nevertheless, following their rapid restoration, the output of mines and refineries already has reached the prewar mark.

The new project provides for rapid development of a vast industrial region, called the Estonian "Donbas," with dozens of big and smaller establishments, including mines, refineries, shale processing gas plants, etc. This region will be developed around the chief shale deposits in Estonia—Kohtla-Jarvi, Kohtla, Ahtma and Kiviili.

In addition to the restoration of the old shale mines, a total of 11 new large fully mechanized mines are being built and are to be put in operation before the end of the next year.

In addition to mining of shales and gas production, the Russians expect to obtain dozens of various byproducts at the refineries, such as gasoline, motor kerosene, diesel oil, fuel oil, a variety of other oils and also varnishes. Alcohol, high-octane motor spirit, sulphur and carbonic acid will be recovered from shale gas. Shale pitch will be used for the production of synthetic dyes, tanning materials, synthetic resins used for plastic materials, and lubricating oils. The Five-Year Plan calls for an 18-fold increase in the production of gasoline from shales and a 14-fold increase in lubricating oils.

Special attention will be devoted to the maximum utilization of the immense quantity of waste products yielded by the shale industry. The Estonian shales contain about 60 percent of mineral ingredients. With the development of the shale industry, several million tons of semi-coke and ash will be obtained annually.

First Paper Mill Operates In Soviet Far East

CONSTRUCTION of the first paper mill in the Soviet Far East has been completed in village Birakan of the Jewish Autonomous Oblast in the Khabarovsk region. Construction of the mill was started during the war. It is equipped with the latest machinery of Soviet make. The first section of the mill is already in operation. Nearby forests are expected to provide timber for the next 60 to 80 years.

Colombia Will Build New Alkali Plants

REPORTS to the U. S. Department of Commerce state that chemical projects are included in the proposed economic-development program of Colombia. Among these are the estab-

The Editor says it for us...

"Carrying out a chemical reaction on a continuous basis and at this temperature (480°F), when fatty acid is one of the reagents involved, was not practical until stainless steels were available as a material of construction... for high pressure equipment. In general the equipment throughout the process is made of stainless steel where the fatty acids are at high pressure (600 psi) or temperature."

Extract from editorial article "Continuous Process for Soap." Chemical Engineering, April 1947.

nothing equals Stainless Steel

DESCRIBING how soap is now being made by the continuous process from raw material to finished product in a matter of hours instead of the many days formerly required, the editorial writer gives well-deserved credit to Stainless Steel.

This is only one of many new chemical engineering processes which rely on high temperatures and higher pressures to obtain better yields, greater speed or lower costs of production. In all of them, the greater severity of corrosive conditions calls for better materials to resist their effects. That is why today Stainless Steel is being used in ever-increasing tonnages by the chemical and allied industries.

In U·S·S Stainless Steel we offer you a complete family of perfected, time-tested Stainless and Heat Resisting Steels that will meet practically any operating condition, whether simple or unusually severe. These steels are available not only in many different analyses but in the widest range of forms, sizes and surface finishes anywhere obtainable.

Based on its past performance, and on very recent applications too, the chances are that in most cases, U·S·S Stainless Steel will exactly fit your requirements. But—to be *sure*, talk over your problems with our engineers before you specify it. These men know what Stainless Steel will do in almost any kind of service. You'll find their cooperation invaluable in helping you to apply Stainless where it is needed and where it can do the best, most efficient job.

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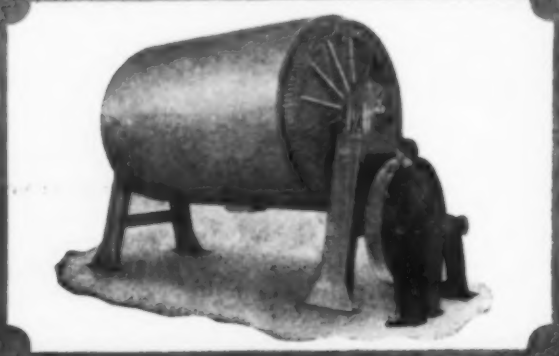

USED BY AMERICA'S LEADING MANUFACTURERS IN THE CHEMICAL PROCESS FIELD

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lishment of alkali plants at Zipaquira, Department of Cundinamarca, near important salt mines. These plants would permit expansion of the country's chemical industry and furnish raw materials for other industrial developments. Mention also is made of possible exploitation of phosphate rock deposits in the Commissariat of Goajira.

Nitrate Deposits Found In Bahia, Brazil

DISCOVERY of what are regarded as important deposits of nitrates and galenites has been reported. The deposits were found in the vicinity of the city of Minas do Rio das Fontes in the State of Bahia, Brazil. Laboratory tests have disclosed that the nitrate samples contain from 54.3 percent to 65 percent sodium and potassium nitrate. The galenite deposit when purified was found to consist of 86.2 percent lead.

Austria Expected To Export Nitrogen Fertilizer

EXPORTS of nitrogen fertilizer amounting to around 8,000 tons monthly are expected to be available from the Linz plant in Austria which was built by the Germans during the war to utilize the coke oven gas of the Hermann Goering Werke, now known as the United Austrian Iron and Steel Works. Basis for the exportable surplus is a barter deal whereby Sweden has undertaken to provide 20,000 tons of Polish coal monthly in exchange for iron and steel products. The Polish coal together with the steel plant's present 25,000 tons monthly Austrian allocation makes possible a fertilizer production of at least 70 percent of capacity or roughly 17,000 tons per month. Production during the last quarter of 1946 was running at 25 percent of capacity and from mid-January until the end of March operations were at a standstill due to the coal crisis.

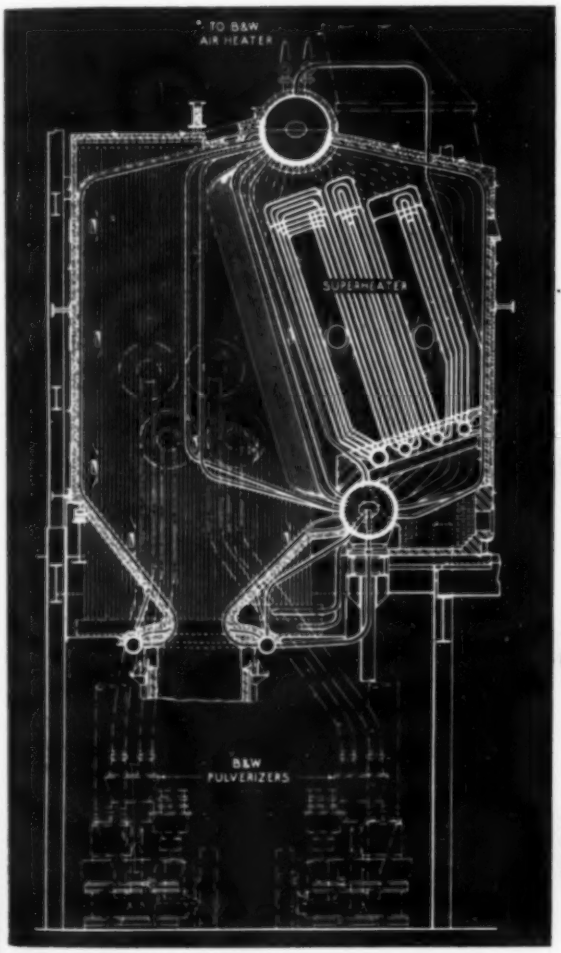
Austria's requirements for nitrogeneous fertilizer amount to roughly half of monthly production at 70 percent of capacity. Prospects of more coking coal being available during 1947 are slim. The Swedish contract is for six months but has an extension clause.

Sulphuric Acid Production United Kingdom and Eire

ACCORDING to data collected by The National Sulphuric Acid Association, Ltd., London, England, production of sulphuric acid and oleum in the

MORE PROOF...

THAT BOILER MODERNIZATION PAYS..



B&W Integral-Furnace boiler installed in the Wyandotte Chemicals Corporation North Plant. Maximum continuous steam capacity, 200,000 lb. per hour at 900 psi and 875F. Fired by pulverized coal and coke-oven gas.

MORE BYPRODUCT POWER
IN SAME SPACE...WITH LESS FUEL
AT WYANDOTTE

Electric demands were growing faster than heating and process steam loads at the North Plant power station of Wyandotte Chemicals Corporation.

PROBLEM To increase power load without producing more process and heating steam than needed.

SOLUTION Topping of existing low-pressure equipment, including installation of new B&W Integral-Furnace Boiler and new high-pressure prime mover.

RESULT Ratio of byproduct power to steam load substantially increased with least investment. Fuel costs reduced. New boiler produces four times more steam than each of the old units, yet occupies no more floor space.

G-340

FOR POWER PLANTS — B&W, Open-Pass, Radiant, Integral-Furnace, Cross-Drum, Stirling and Waste-Heat Stationary Boilers . . . Air Heaters . . . Economizers . . . Superheaters . . . Water-Cooled Furnaces . . . Oil, Gas & Multifuel Burners . . . Chain-Grate Stokers . . . Stacks and Breechings . . . Seamless & Welded Tubes for All Pressure and Mechanical Applications . . . Refractories . . . Chemical Recovery Units . . . Alloy Castings.

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DESICCANT

The high-pressure dehydration unit here illustrated is a property of the United Gas Pipe Line Company at Carthage, Texas. It represents the most advanced design, construction, and operating technique; and the drying agent employed is FLORITE DESICCANT. The Stone & Webster Engineering Corporation, who designed and constructed the plant, are users of FLORITE in various types of equipment, large and small, for oil and gas companies and for other branches of industry.

Natural gas, propane, butane, gasoline, air, nitrogen, carbon dioxide, refrigeration compounds, all are treated with superior drying efficiency by use of FLORITE. Selectively adsorbs 4 to 20% its weight of water—is regenerated by heating to 350°F. Write for literature, names of important users in your own field.

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Department A, 220 Liberty St. Warren, Pa.

United Kingdom and Eire for the three-month period, April-June 1947, amounted to 347,005 tons in terms of 100 percent acid. This total does not include the output of government plants except those which produce acid for trade purposes. Total capacity represented is 427,590 tons with operations at 81.2 percent of capacity. Raw materials consumed include 71,291 tons of pyrites, 44,307 tons of spent oxide, 55,581 tons of sulphur and hydrogen sulphide, and 44,094 tons of zinc concentrates.

Summary for Sulphuric Acid

April-June 1947, tons of 100 percent

	Chamber	Contract	Total
Stocks April 1	39,713	33,036	72,749
Production ..	170,710	176,295	347,005
Receipts	36,546	35,303	71,848
Oleum feed ..	—	2,514	2,514
Adjustments .	−45	+153	+108
Consumption .	104,505	71,382	175,887
Despatches ..	106,202	143,827	250,029
Stocks June 30	36,216	32,092	68,308
Capacity represented ...	221,890	205,700	427,590
Percent operated	76.9	85.7	81.2

Production of Uranium In The Belgian Congo

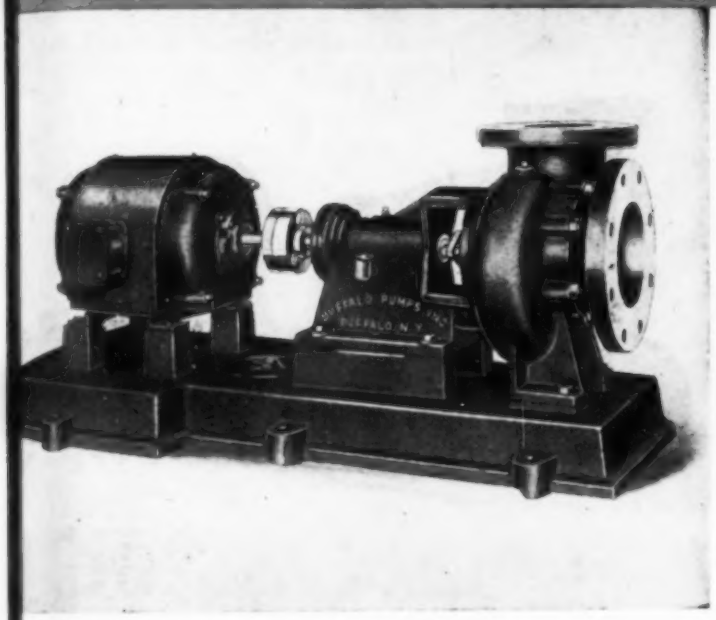
SHINKOLOBWE, the uranium mine of the Union Miniere Du Haut-Katanga near Jadotville in the Belgian Congo, is reported to be working at full capacity. In 1943, 8,287 metric tons of uranium ore were shipped to the United States via the port of Lobito. The following year, the figure was raised to 9,967 metric tons. Since then, figures for shipments have not been revealed. The wartime agreement between the Belgian Government and the Allies by which all the uranium produced in the Belgian Congo was placed at the disposal of the Allies, still is in effect. Paul-Henri Spaak, Premier of Belgium, recently said this agreement will be reviewed with any decisions by the United Nations Atomic Energy Commission taken into account.

Three-Country Agreement In Plastics Field

WRITING from Amsterdam, McGraw-Hill World News reports that an agreement has been signed in Delft, Holland, to stimulate research and pool new discoveries in the plastics field in the Netherlands, Belgium, and Great Britain. The three parties to the two-year agreement are the British Institute for Plastics Technology, the Flemish Engineers Association, and the Delft Research Laboratories for Applied Sciences.

Commenting on the action taken, J. J. Cleaver, a director of the British Institute, said that Great Britain is not behind in theoretical development of plastics but is lagging behind the

ACETIC ACID TO ZINC SULPHATE
PUMPING EFFICIENCY



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CHEMICAL SERVICE PUMPS

Buffalo Chemical Pumps such as this Class "CS" may be "tailored" to each job by the proper lead or alloy fittings . . . assuring the utmost service life and efficiency for the particular liquid pumped. Write for Bulletin 982.

Corrosive liquids, slurry, acids, gritty liquids and all kinds of temperatures are continually confronting operators responsible for pumping performance in chemical installations.

Yet operators can avoid premature wear and other pumping "headaches" by ordering the right "Buffalo" Pump. For practically every liquid handled, there is a husky, high-delivery "Buffalo" Pump of the proper alloy, lead or rubber construction to give you *added years* of trouble-free service.

Why not write us about your problem, describing liquids pumped, heads, temperatures, etc? We'll be glad to make cost-cutting recommendations.

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501 Broadway Buffalo, N. Y.
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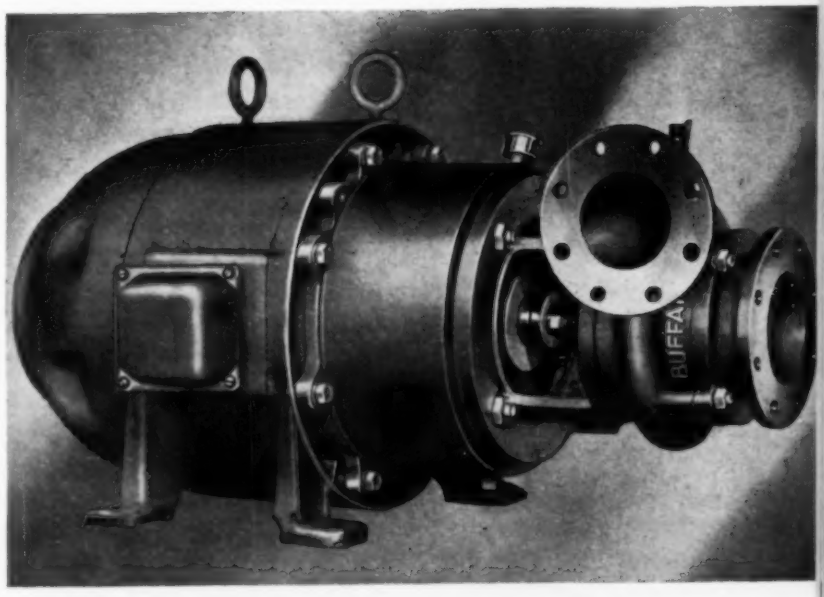


CRAMPED FOR SPACE? A rugged, compact Buffalo Close-Coupled Pump may be just your answer. For the many types of liquids it handles, all performance and construction details, simply write for Bulletin 975-B.

"Buffalo" "CS" AND "CC" PUMPS

One-piece Permanite dip tank for acid or strong alkali solutions.

PERMANITE CONSTRUCTION:-

Versatility in Acid - Alkali Service

Not a coating, paint or lining, Permanite is a light, tough, structural material, corrosion-proof **clear through.** Reinforced with woven fiber glass, it is not easily broken. It handles non-oxidizing acids, all alkalies, oil, most solvents and will withstand thermal shock and temperatures to 360°F. Besides being used by Knight engineers as structural material in complete functional units as Fume Washers and Absorbers, Permanite is also used in individual pieces (standard or special design) as: sinks, tanks, trays, grids, tower covers, etc. Permanite may be used in conjunction with whatever other materials a given situation calls for. For instance, Permanite-armored Knightware pipe withstands greater pressures, physical and thermal shock and won't shatter.

Fume Washers of Permanite Construction

Permanite-armored Knightware pipe is tougher

Write giving full details as to your particular needs. Our engineers will be glad to advise you.

Maurice A. Knight
109 Kelly Ave., Akron 6, Ohio

United States in commercial exploitation. The present agreement, he said, is aimed at elimination of competition between the three countries and their cooperation in order to catch up with this lag.

El Salvador To Increase Chlorine Production

WITH equipment from the United States, a new plant for production of chlorine and caustic soda is being established in El Salvador and is expected to be in operation before the end of this year. Both these chemicals have been in short supply for some time and soap makers, in particular, have been handicapped by the inadequate supply of caustic soda.

Foreign News Briefs

Plastic molding material containing lignin has been developed by Associated Pulp & Paper Mills, Ltd., Melbourne, Australia. It is obtained by precipitating with acid the lignin from a solution of black stock in the presence of cellulosic fibers.

Window glass production in Belgium, by official decree, was placed under government control last March. This control will continue through all of 1948.

A site near the Royal Netherlands Salt Industry is being considered by the Royal Weaving Co., of Hengelo, Netherlands, for a new plant to produce a variety of chemicals.

Palm oil producers in the Belgian Congo have asked the Belgium Government to change current marketing arrangements so they may export to South Africa and the Rhodesias. At present all Congo production must be delivered to Belgium at $200 a ton whereas the world market price is $320 a ton.

Lecithin production has started at the new plant of Lecithin Products (Canada) Ltd., in Belleville, Ont., Canada. Douglas Willians is manager. The Canadian company is owned by the W. A. Cleary Corp. of Chicago and New Brunswick, N. J.

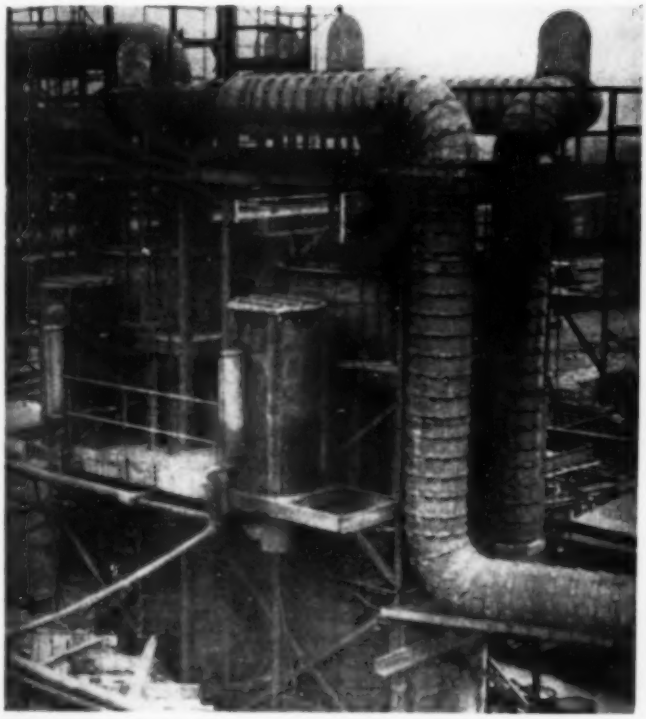
Russia is reported to have offered Denmark delivery of 100,000 metric tons of potash valued at $4,166,000 as part payment of the Soviet Union's debt. A large deposit of ozokerite is said to have been discovered in the Soviet Union. Press reports say a large plant for processing the wax is expected to be in operation before the end of this year.

THE CORROSION FORUM

MODERN MATERIALS • MODERN METALS

of Chemical & Metallurgical Engineering

Edmond C. Fetter, ASSISTANT EDITOR



Sulphur Dioxide versus Construction Materials

This is Part III of a three-part symposium in which manufacturers of typical materials of construction evaluate their products for services involving wet and dry sulphur dioxide and sulphurous acid. Exemplifying such chemical plant work is the group of Cottrell electrostatic precipitators (left) used to remove sulphuric acid mist from sulphur dioxide gas. Both the precipitators and the ducts are made of lead supported by steel structures.

HAVEG

E. P. MAMPE
Haveg Corporation
Newark, Del.

HAVEG equipment has an excellent service record under all operating conditions involving sulphur dioxide coming within the physical limitations of a plastic material. It has been used with complete success under a wide variety of conditions of temperature, concentration, moisture, and pressure, both with sulphur dioxide alone and in combination with other chemicals. Haveg 41 has been used over a period of fourteen years, without showing any evidence of attack due to wet or dry sulphur dioxide or sulphurous acid, in such equipment as fume duct, pipe and fittings, jets, cooler manifolds, tanks, and similar equipment.

Haveg 60, although of more recent origin, also has been proven to be equally resistant.

It should be emphasized that Haveg is not a lining or coating, but a construction material, and therefore, the corrosion resistance it provides is not merely a surface condition but exists throughout the entire mass of the material. In addition it is tough, durable and unaffected by thermal shock.

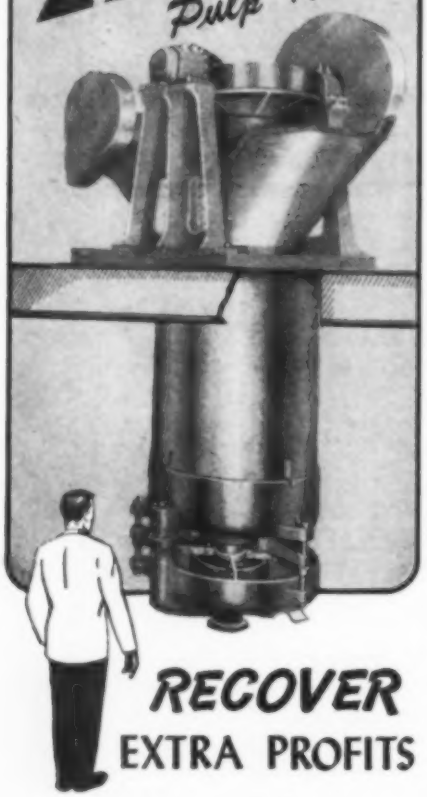
LEAD

H. M. CHURCH, Jr.
Lead Industries Assoc.
New York, N. Y.

SINCE 1746, when the first lead chamber was used in Birmingham, England, for making oleum, lead has proved its worth in handling sulphur dioxide and related compounds, such as sulphuric acid, sulphurous acid, sulphur chloride and sulphur trioxide. Lead suffers practically no corrosive effects from SO_2 gas, whether cold and dry or in hot, moist condition up to 390 deg. F. In fact, lead is the standard material for handling the above corrosives.

The magazine, *Lead*, a publication of the Lead Industries Assoc., carried an article in its issue of July-August, 1946, on the replacement of a lead duct in the sulphuric acid plant of a southern chemical company. A 28-ft. lead duct, 42 in. in diameter, had given 29 years of excellent service before being replaced. The sheet lead was not appreciably corroded and the only signs of failure necessitating replacement were near the steel supporting bands. Vapors pass through at temperatures of approximately 235 deg. F. at the top where they leave the Glover tower and 205 deg. F. at the bottom where they enter the nitre pot carrying a mixture of sulphur dioxide and sulphur trioxide. To form the new duct, 10-lb. sheet lead was wrapped around mandrels of the proper size, welded longitudinally and supported by lead covered steel bands

J&C
ZENITH
Pulp Press



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... by Increasing
PRESSING EFFICIENCY

New uses for the Zenith Pulp Press are being discovered every day. Among the many installations for DEWATERING are: BEET PULP • PINEAPPLE • TOMATO POMACE • CORN GERM and FIBRE • VEGETABLES • BREWER'S GRAIN CHERRIES • CITRUS FRUITS • FISH • PAPER PULP RECLAIMED RUBBER • TANKAGE • etc.

100% continuous . . . from storage bin to pressed cake, the Zenith Pulp Press dewaters up to 26 tons of wet pulp per hour.

The material is fed mechanically to a tapered screw-type spindle that compresses and forces it through the press, discharging liquid through the central orifice and pressed cake to conveyor for disposal.

Constantly rolling pulp assures maximum dewatering. Heater resistors permit steam injection.

A Pilot Press is available for trial in your plant.

"Work Well Done Since '81"

A PRODUCT OF
Jackson & Church Co.
SAGINAW, MICHIGAN

on 4-ft. centers. This duct, when welded in place and supported by a steel structure was ready to give at least another 30 years service. Throughout this period of uninterrupted service the lead duct conveyed hot corrosive vapors while being exposed to the atmosphere on its external surface.

From the roasting of lead, zinc, and iron sulphides large amounts of hot SO_2 vapors with other oxidation products are handled in lead ducts and in lead lined equipment. The actual conversion of the SO_2 to concentrated sulphuric acid is accomplished by the contact process, but extensive use of sheet lead is made in the purification of the hot gas coming from the roasters prior to its conversion. In one plant of this type a corrosive liquor saturated with SO_2 and at 125 deg. F. has been handled in lead equipment with little or no corrosion since 1937. Among other corrosives in the liquor are sulphuric acid, 56.5 g. per l.; chlorine, 1.9 g. per l.; and ferrous iron, 4.1 g. per l.

In the manufacture and handling of sulphurous acid for the sulphite paper process lead has many uses. The hot SO_2 gas is taken through a cooling system which usually consists of 100 or 200 ft. of 8 or 12-in. lead pipe undergoing a continuous cold water spray. Lead fans impell the gas countercurrent to a water stream through limestone packed towers to form the sulphite liquor which usually contains 1 percent SO_2 combined with lime and 5 percent free SO_2. Sulphite liquor and wood chips are brought into a digester with a lining of acidproof brick set in a cement made of litharge (PbO), sand, and glycerine. Here temperatures vary from 250-300 deg. F. and pressures are 75-125 psi. At the digester top 1-in. antimonial lead covers, 36 in. in diameter, have given good service at 250 deg. F. at 20 percent of the cost of covers previously used.

Lead digester relief valves, usually 2 or 4 in. in diameter, have been successfully used on the digester cover where relatively low velocities of steam and SO_2 are encountered. Lead is not suitable for relief regulating valves for digesters as steam and SO_2 are encountered at 250 deg. F. and pressures of 75-125 psi. Other materials, much harder than lead, are rapidly cut to pieces in this service where the valves are never fully opened. Thousands of feet of antimonial lead pipe are used in digester relief lines in the various sulphite mills throughout the country. These lines are immersed in cooling water for a great part of their length so that the SO_2 gas will be more readily absorbed in the recovery tower. Lead pipe has proven to be the most satisfactory and economical material available for digester relief lines. In addition, quite a few lead lined wooden tanks and lead pipe lines are used in the sulphite pulp industry to handle the sulphurous acid, SO_2 gas, and also the acid alum which is used in paper making.

Lead lined equipment has proven very satisfactory for neutralizers, evaporators, and settlers used in the manufacture of potassium metabisulphite (see *Chem. & Met.*, Nov. 1945, p. 231), a product which demands high purity and freedom from soluble lead salts because of its use as a fermentation arrester in wineries and as a preservative for photographic solutions. An excess of sulphur dioxide is encountered in the neutralizer of wood and lead lined construction, wherein liquid SO_2 is introduced.

TANTALUM

FREDERICK L. HUNTER
Fansteel Metallurgical Corp.
North Chicago, Ill.

UNDER most circumstances, there are so many materials resistant to wet or dry SO_2 or sulphurous acid that tantalum, because of its relatively high cost, is not necessary.

Tantalum is completely immune to sulphurous acid at any concentration or temperature in the liquid phase, and to sulphurous acid vapors or dry SO_2 at

Corrosion Meeting

THIRD Annual Symposium on Modern Metal Protection, sponsored jointly by Cleveland section of the American Chemical Society, The Electrochemical Society, and the American Institute of Chemical Engineers, will be held at the Hotel Carter in Cleveland, September 27. As in past years, morning and afternoon sessions will be held, with a group luncheon at 12:30. The program is as follows:

Morning Session, 9:30 a.m.

"Some Notes on the Corrosion Behavior of High Nickel Alloys and Stainless Steels," H. O. Teeple, International Nickel Co.

"Selection of Protective Coatings for Metal Protection," K. G. Compton, Bell Telephone Laboratories.

"Corrosion Resistant Chemical Equipment of Stainless Steels," H. L. Maxwell and W. R. Myers, E. I. du Pont de Nemours & Co.

"Corrosion Resistance of Hastelloys and Applications in Processing Equipment," R. B. Long, Haynes Stellite Co.

Afternoon Session, 2:00 p.m.

"Synthetic Rubber Derivatives as Corrosion Resistant Coatings," J. B. Martin, Hercules Powder Co.

"Organic Coatings for Corrosion Protection," E. R. Weidlein and George W. Seagren, Mellon Institute of Industrial Research.

"Protective Coatings for High Temperature Applications," W. N. Harrison, Chief, Enameled Metals Section, National Bureau of Standards.

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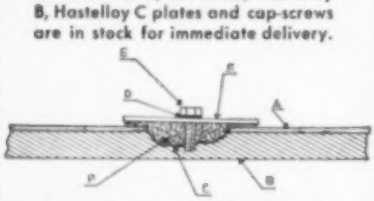

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B-Steel Plate *E-Alloy Cap Screw*
C-Carboline Primer *F-Alloy Repair Plate*

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temperatures up to 350 deg. C., provided that no free SO_3 is formed by catalytic or other action. If there is evidence or probability of the formation of SO_3 during the reaction, tantalum should be tested under the actual operating conditions before deciding on its use.

There are certain conditions, especially when it is contaminated with other materials, when sulphurous acid can be extremely corrosive. Likewise, sulphur dioxide or sulphurous acid can become a troublesome component in food, drug or fine-chemical products where, by corrosive action on the equipment, it causes contamination of the product. Under such conditions, where common materials of construction fail, tantalum may be used economically for heaters, coolers, condensers, diaphragms, thermometer wells or other vital parts.

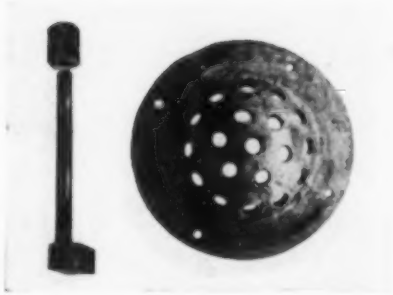
HASTELLOY

C. G. CHISHOLM
Haynes Stellite Co.
Kokomo, Ind.

WET and dry sulphur dioxide gas is usually present in flues and furnace atmospheres when sulphur dioxide is a product of combustion. Temperature and moisture conditions have considerable bearing on the corrosion rates of this gas coming in contact with the alloys. In general, high chrome or chrome-nickel steels successfully resist the flue gases and furnace atmospheres, the amount of chrome or chrome-nickel depending upon the temperature.

Hastelloy alloys A and B resist wet and dry sulphur dioxide gas effectively but only at temperatures up to 1,400 deg. F. Hastelloy-C, however, resists this gas at temperatures up to 2,000 deg. F. because of its chromium content and superior oxidation resistance. For this type of service Hastelloy alloys should, in general, be used only on those parts that must withstand severe stresses. For straight oxidation resistance and resistance to the corrosive attack of sulphur dioxide gas, wet or dry, the superiority of Hastelloy alloys is not sufficient to justify the use of these higher priced alloys instead of high-alloy stainless steels. The superior strength of these alloys at higher temperatures, however, makes their use for highly stressed parts particularly satisfactory from the standpoint of long life and resultant economies. The ultimate tensile strength of Hastelloy alloy is in excess of 60,000 psi. at 1,500 deg. F.

A grating made of Hastelloy-C has been used successfully by a large power plant. It has been in service for approximately seven years and shows very



little sign of attack. The cut shows one of the grates, installed at the bottom of a large brick stack at this power plant, and the anchor bolts which were set into the brickwork. One of the large paper companies has used large Hastelloy-C jacketed castings for cooling sulphur dioxide gases with excellent results.

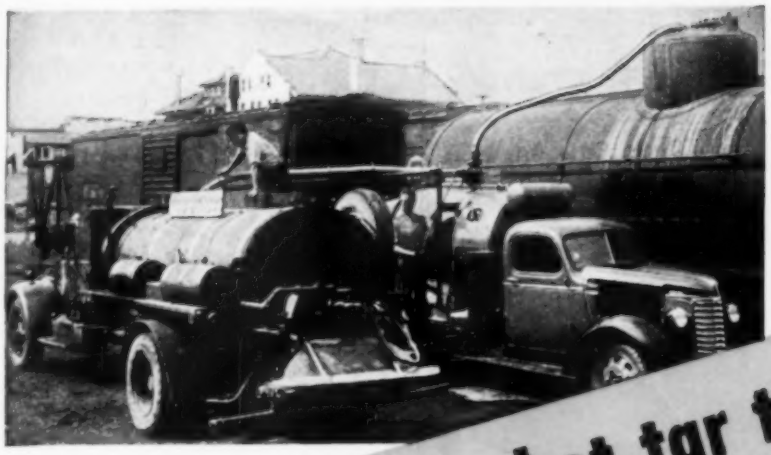
Sulphurous acid as used in the pulp industry for sulphide digesters presents a severe corrosion problem. In most cases, however, this acid has been adequately handled by 18-8 stainless steels, although straight chrome steels containing a minimum of 12 to 15 percent alloying ingredients will often serve the same purpose. The presence or additions of impurities, such as small amounts of sulphuric acid or sometimes sodium chloride, appreciably accelerate the attack on 18-8 and higher alloys.

The following tests show that Hastelloy alloys are not appreciably affected even though impurities are present. In these tests sodium bisulphite was produced by the reaction of sodium hydroxide and sulphur dioxide in a closed vessel. Specimens of Hastelloy alloys A, B, and C were also inclosed in the same vessel. The tests were run for 99 days at temperatures of 130 to 140 deg. F.

	Normally Acid Sol.	Normally Alk. Sol.
Hastelloy A.....	8.5 mils/yr.	4.6 mils/yr.
Hastelloy B.....	5.6	2.8
Hastelloy C.....	0.1	0.02

Tests were also conducted with the mother liquor (ammonium chloride and sodium sulphite) encountered in the manufacture of ammonium chloride. These experiments were run over a period of 30 days at 140 to 147 deg. F. The rate of loss per year for Hastelloy-B was 0.8 mils and less than 1.0 mils for Hastelloy-C.

In the pulp and paper industry, a calcium-base cooking process has been used for many years in the sulphite mills and the waste liquors dumped into streams and bays. Recently, however, the trend has been toward recovering some of this waste liquor. Since it is extremely difficult to evaporate a calcium-base liquor, some consideration is being given to magnesium, ammonium, and sodium base, so that



American Steel Interlocked Flexible Tar and Asphalt Hose is here being used on tank car unloading equipment made by the Cleaver-Brooks Company of Milwaukee, Wisconsin. This type of hose is ideal for conveying hot tar and asphalt, since it is adapted to rough handling and is unaffected by the heat and chemical action involved in such use.

From pumping hot tar to shielding ignition systems

In the Glenn L. Martin Company's new "2-0-2" transport, American HTCD Shielding Conduit shields the ignition system and prevents interference with radio and radar operation. This conduit consists of an inner core of fully interlocked stainless steel flexible tubing, two layers of tinned copper wire braid and, finally, a molded synthetic cover for protection against moisture, dirt, dust and oil.

Flexible Metal Hose Performs Best

FOR A WIDE RANGE OF USES, such as transferring hot tar and asphalt, or shielding an airplane's ignition system to eliminate interference with radio and radar, there is a flexible product of American Metal Hose—specifically engineered for the job.

Wherever vibration, misalignment or connecting moving parts creates a problem in the conveyance of steam, oil, water and other liquids or gases, a most economical and efficient solution can usually be found in the American line:

American Metal Hose is available in brass, bronze, aluminum, steel, and other metals, some of these in sizes up to 12" I.D.—made from strip in four spirally wound types. *American Seamless Flexible Metal Tubing,* as flexible as garden hose and as leakproof as the seamless bronze tube from which it is made, is standard in sizes ⅛" to 4" I.D. Either hose or tubing can be furnished complete with fittings to your exact specifications.

Descriptive literature will be mailed on request, and our Technical Department will be glad to help on exceptional problems. 47294

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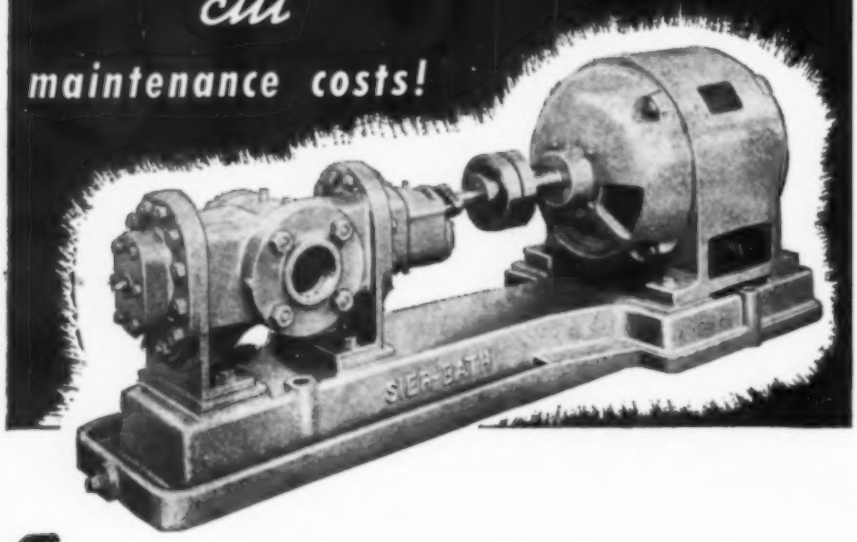

The high quality of design and construction of Sier-Bath Screw Pumps enables them to operate continuously for long periods without maintenance. The pulseless flow and vibrationless operation of these pumps greatly reduce maintenance cost—there is less wear on valves, couplings and other fittings. Pipes and joints remain tight and require little attention. With maintenance labor costs at an all-time high, these are important points to consider today in the selection of pumps.

Made in an up-to-date machine shop, accustomed to precision methods and equipped with the most modern machinery, Sier-Bath Screw Pumps always measure up to the highest standards required by users. They are made in both horizontal and vertical models.

Sier-Bath customers are protected from mis-application by the mature pump engineering experience of this Company's staff. Send for descriptive booklet.

ADVANTAGES:
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most of the base and the sulphur can be recovered. When the calcium base is used in the cooking process, Type 316 stainless steel has proved quite adequate because of the protective scale of calcium sulphate that is built up. This protective film eliminates all corrosion troubles. When an ammonium-base cooking process is used, however, no scale is built up, and the corrosion problem is a severe one. Under such conditions, Hastelloy-C has shown up very favorably in tests. An appreciable amount of Hastelloy-C production equipment has recently been installed where the ammonium-base cooking processes have been developed.

STAINLESS STEEL

Research Department
Allegheny-Ludlum Steel Corp.
Pittsburgh, Pa.

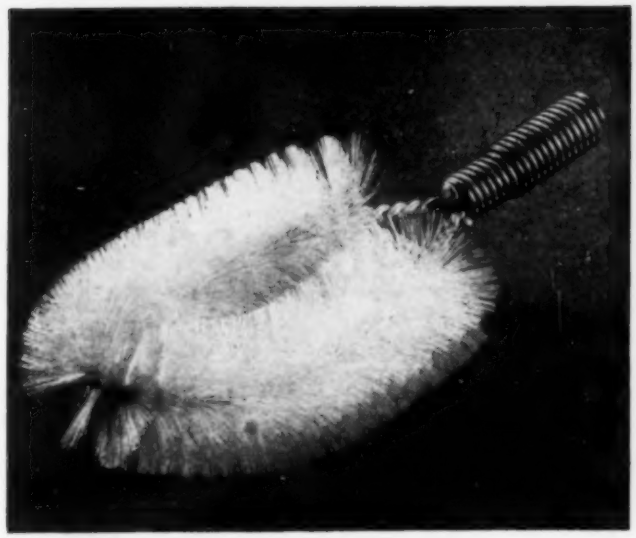
STAINLESS steel provides valuable corrosion resistance in many applications where sulphur dioxide, sulphurous acid, or solutions of these agents are encountered. It is especially valuable in the pulp-making industry, where sulphite acid liquors containing free sulphur dioxide and an excess of sulphurous acid must be handled in equipment including heat exchangers, digester circulating systems, digester relief lines, steam injectors, various tank linings, tie rods, and other related installations. Stainless steel is used also for reaction vessels for combining SO_2 with other substances, for SO_2 absorbers, and for tanks to hold liquids containing SO_2 in solution. Dry gaseous SO_2 and combustion products containing SO_2 are conveyed in tubes, exhaust pipes, flues for roasting furnaces, and stacks for burners using fuel oil or industrial fuel gas.

Stainless steel Types 304, 308, 316, 317, and 329 have been widely used in the sulphite pulp industry. Of this group, Types 316 and 317 are preferred for heat exchangers, digester circulating systems, and relief lines which are exposed to the liquors containing sulphuric and sulphurous acids formed by the combination of sulphur dioxide and water. Where the corrosive conditions are less severe, as in steam injectors and blow pit linings, Types 308, 329, and in certain instances even 304 may be used.

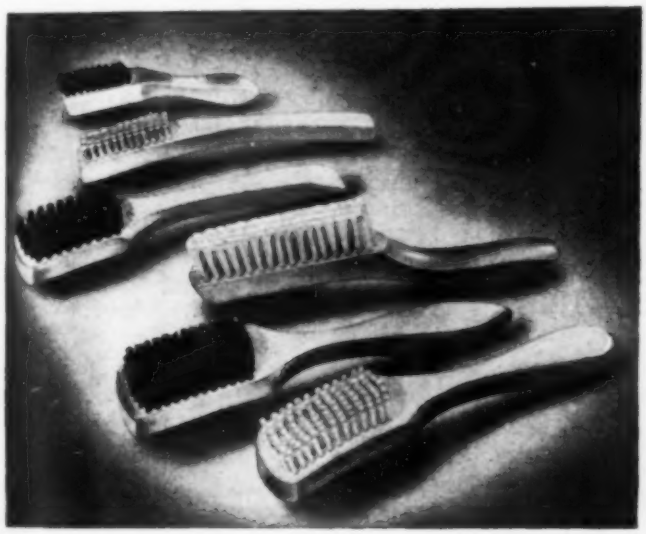
Liquids such as processed fruit juices containing small percentages of SO_2 completely in solution as a preservative are safely stored in tanks made of Type 302 or 304. However, if the saturation limit of the liquid is exceeded in closed tanks, corrosion may occur above the liquid level. Type 316 and Type 317 pipelines, valves, and pump parts provide good service for

HOW CAN NYLON BRISTLES WORK FOR YOU?

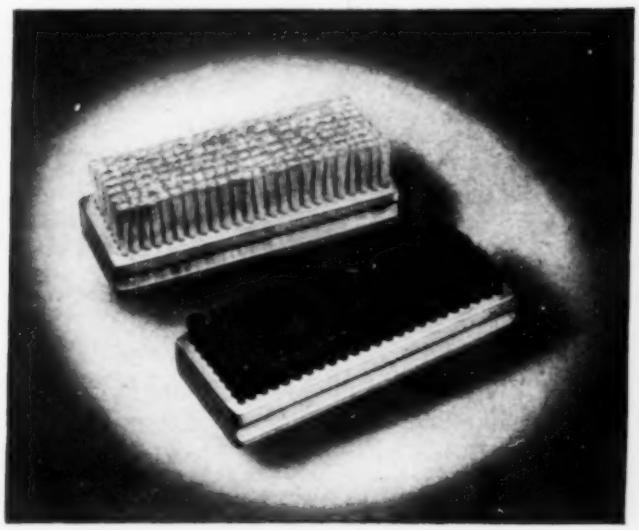
Here are 3 ways brushes bristled with Du Pont NYLON are serving the chemical and allied industries



1. SYRUP TANK BRUSH, bristled with Du Pont nylon, stands up on the job far longer than similar brushes with other types of bristles. Nylon bristles are unaffected by cleaning agents, resist constant immersion, most chemicals and abrasion.



2. SPOTTING BRUSHES with Du Pont nylon bristles are used in the dry cleaning industry. They outlast brushes made with other types of bristles, save money in replacements.



3. BENZINE BRUSHES bristled with nylon withstand hydrocarbon solvents, constant abrasion and flexing. Such brushes are made to meet specific requirements and can be had in various degrees of stiffness or softness, depending on the job.

LONGER, MORE EFFICIENT SERVICE

That's what you get in brushes made with Du Pont nylon bristles. And that's why more and more industries today look to nylon for the answer to their brush problems. Like the manufacturers who profit with the brushes shown above, you may find a nylon-bristled brush to serve you more efficiently. In some cases, nylon bristles outlast other types of bristles up to 12 to 1. Just write us describing your brushes, and we'll be glad to work with your regular brush manufacturer—or help you locate the firm that will make nylon-bristled brushes to meet your exact needs. E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Room 109, Arlington, N. J.

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handling sulphurous acid and solutions containing SO_2.

Type 316 units are suitable for the manufacture of chemical compounds such as sodium bisulphite which is made by bubbling SO_2 through a mixture of soda ash and water, provided that vapors are not inclosed above the liquid level.

Absorbers made of Types 316 and 317 have given satisfactory performance for collecting wet SO_2 gas when operated under properly controlled conditions.

The stainless steels are highly resistant to dry SO_2 at temperatures as high as 1,200 deg. F., but the rate of attack increases appreciably upon further elevation of temperature. If moisture is present and condensation of the vapor occurs in the lower temperature ranges, the severity of corrosive attack will depend upon the extent of condensation and other operating conditions.

Types 430 and 316 afford long service life in commercial equipment for handling combustion products containing SO_2. Corrosion in such applications is encountered chiefly in the presence of condensed moisture which permits the formation of mixtures of sulphurous and sulphuric acids. Type 430 is used for parts of stacks and flues that are subject to operating temperatures above 800 deg. F. where condensation does not occur. Type 316, which is more resistant to sulphurous acid and weak sulphuric acid, is used for the cooler sections of the equipment.

Many of the corrosion problems associated with SO_2 and sulphurous acid applications arise from the incidental formation of more corrosive substances due to certain operating conditions as discussed above. Competent technical advice often can eliminate such difficulties prior to installation.

CHEMICAL STONEWARE

F. E. HERSTEIN
General Ceramics & Steatite Corp.
Keasbey, N. J.

CHEMICAL stoneware is inert to both wet and dry SO_2 and sulphurous acid at all concentrations and all temperatures at which stoneware is commonly used. Its use in handling of these materials is therefore limited only by economic considerations and the extent of thermal shock prevalent in any particular installation.

One of the widest uses of chemical stoneware in connection with SO_2 and sulphurous acid is in the absorption of SO_2 to form sulphurous acid. Chemical stoneware towers up to 48 in. diameter and as high as 35 or 40 ft. are used for this purpose. The packing

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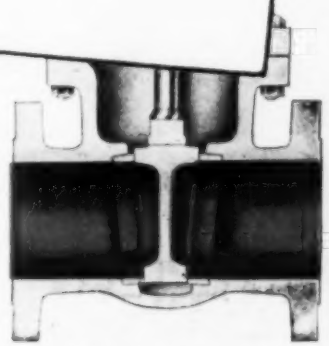

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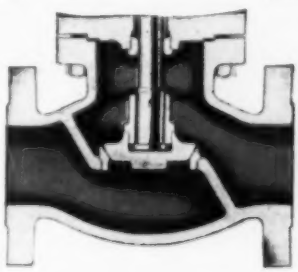
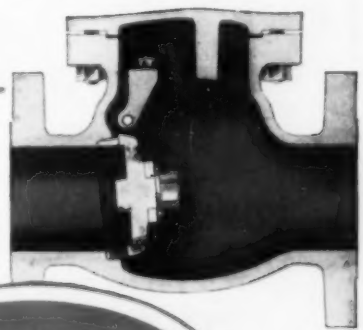
OIC GATE VALVES with flanged and welding end provide straight-through flow without recesses or pockets between the valve ports and seat openings. Screwed end valves are designed for the smoothest possible flow with a threaded joint.



Streamlined.....

OIC GLOBE AND ANGLE VALVES are designed with a disc guiding in all pressure classes to eliminate the necessity of a bridge across the seat opening, thereby reducing pressure loss through the diaphragm to a minimum. Flow of the line fluid, whether gaseous or liquid, is expedited.



Streamlined.....

OIC CHECK VALVES have bodies designed for unobstructed flow where the disc is in the wide open position. Streamlined internal contours from port to port reduce turbulence and consequent pressure loss to a minimum.

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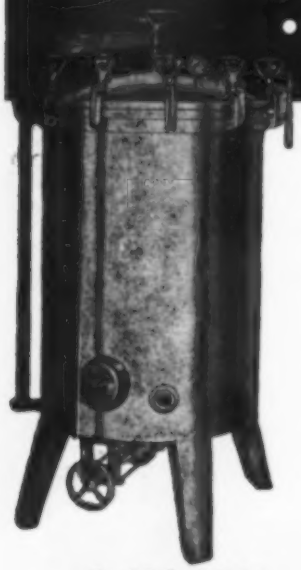
• Full Drainage



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material for these towers is usually chemical stoneware rings. The piping, circulating sumps, pumps, and other accessories for an SO_3 absorption system can also be made of stoneware.

Besides the application mentioned above, chemical stoneware can also be used for any other handling operation involving SO_3 and sulphurous acid at temperatures below 220 deg. F. Where sulphurous acid is used as an anti-chlor in textile plants stoneware piping and pumps are used for handling.

A complete line of process equipment including towers, pumps, piping for both liquids and gases, vessels of various capacities up to 750 gal., and valves and fittings is available in chemical stoneware for the handling of wet and dry SO_3 and sulphurous acid under the conditions outlined above.

WOOD TANKS

S. E. CHANEY
National Wood Tank Institute,
Chicago, Ill.

THE PRINCIPAL uses for liquid SO_2, SO_2 gas, and sulphurous acid are in refrigerating machines, wood pulp manufacture, glue manufacture, gelatine manufacture, disinfecting, purification of beet root juices, petroleum refining and the extraction of organic material from coal.

The following service data for tanks used in sulphite mills may be helpful. These data were supplied by sulphite mill operators, and are believed to be typical of the industry.

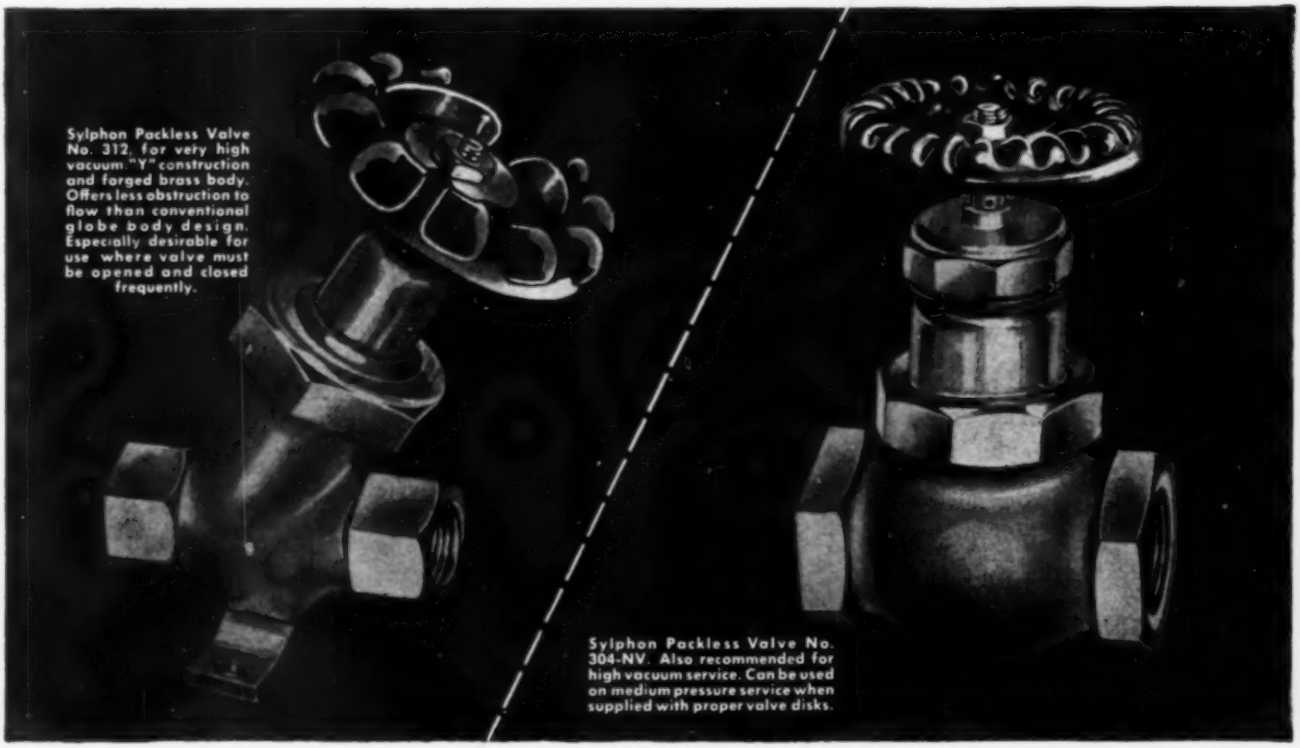
Wood tanks are used almost universally for the storage of raw sulphite acid. The concentration of the acid is 4 to 5 percent total sulphur dioxide with 1 to 1.5 percent combined sulphur dioxide. The temperature is generally 15 to 20 deg. C. The life of these tanks is 10 to 15 years; some have been known to last longer. A typical tank may be 20 ft. in diameter and up to 22 ft. high.

Wood tanks are also used as reclaimed or cooking acid storage tanks. The concentration of the acid may be 5 to 6 percent total; temperature will range from 30 to 40 deg. C. or above. When the temperature is above 40 deg. C., the life may be 5 to 7 years. When the temperature is below 35 deg. C., then the life of the tanks may be 10 to 14 years.

Wood tanks with tile lining are generally used for temperatures above 40 deg. C. The wood tanks are of the same general size as indicated for the raw acid tanks.

One pulp and paper plant operator reports having three 12x25-ft. tanks made of southern yellow pine 6 in. thick in use for the storage of sulphite

For positive maintenance of High Vacuum


Sylphon Packless Valve No. 312, for very high vacuum. "Y" construction and forged brass body. Offers less obstruction to flow than conventional globe body design. Especially desirable for use where valve must be opened and closed frequently.
Sylphon Packless Valve No. 304-NV. Also recommended for high vacuum service. Can be used on medium pressure service when supplied with proper valve disks.

—rely on SYLPHON Packless Valves

Pictured on this page are two Fulton Sylphon Packless Valves for use where maintenance of high vacuum is vital. They've been designed by engineers who have specialized for years in the development of valves for vacuum, refrigeration, oil, gasoline and other services involving gases or liquids.

They provide the kind of service and vacuum protection that is dependable, accurate. One customer has reported the successful use of No. 312, for example, in a system where vacuum of the order of 3×10^{-7} mm. (.003 micron) was obtained.

Valve stem construction in the No. 312 provides back-seating. No packing of any kind is used in either valve—the Sylphon bellows providing a positive seal that protects against leakage.

Rugged, reliable, engineered for long, satisfactory service—in chemical industry, electrical industry and in other applications where steam, air or liquids are handled. Other types available. Send for Bulletin RC-813 that gives detailed information.

FS

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Temperature Controls • Bellows Devices • Bellows Assemblies

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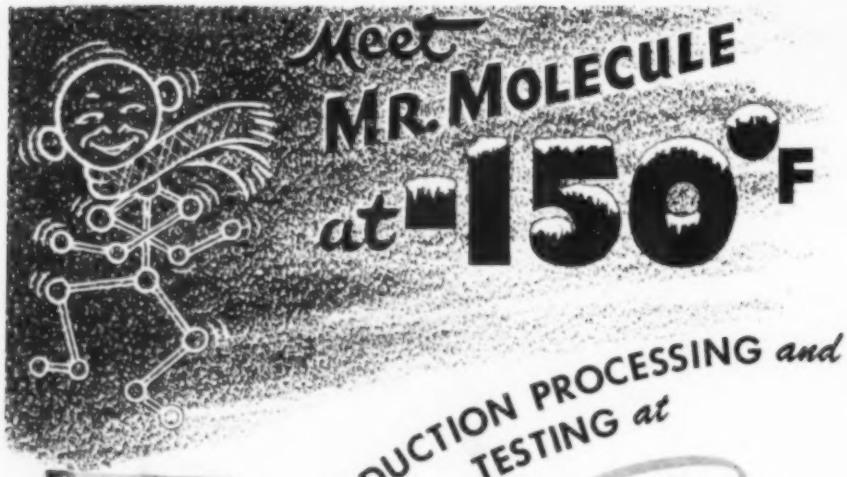

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Bowser processing, testing, storage or cold treatment of many materials can reduce production costs and maintain product uniformity.

Where low temperature is indicated, Bowser cuts costs because no expendable refrigerant is used. Bowser low temperature equipment opens new fields of chemical development to profit-minded organizations.

Special application, specification-built, temperature, vacuum and/or humidity units are also designed by Bowser to meet requirements of any size for laboratory, research and processing applications.

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Work Capacity

MODEL	Length	Width	Depth	Temp.
T2-45	21"	11"	14"	At −45° F.
T2-60		As Above		At −60° F.
T4-45	23"	21"	14"	At −45° F.
T4-60		As Above		At −60° F.
T5-150	25"	25"	14"	At −150° F.
T11-150	55"	25"	14"	At −150° F.

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cooking acid. Strength is 4.85 percent total, 2.0 percent combined. The temperature is 86 deg. F. These tanks have been in service for 12 years and at present are in a good condition.

Another operator has a 12x12-ft. machine chest made of white pine 3 in. thick. This tank handles sulphate pulp slush of pH 5.0 at a temperature of 80 deg. F. It has been in use for 10 years and is in good condition.

Another operator reports a stock chest 12x12 ft. made of cypress 3 in. thick. This tank stores paper stock 96 percent liquid at a temperature of 60-65 deg. F. It has been in use for 18 years but is showing deterioration by water and slight acid attacks due to alum. It is estimated these tanks will give three years more service.

Another operator reports machine chests 14x16½ ft. made of red pine 3 in. thick. These tanks handle newsprint stock, the temperatures ranging from 60 to 100 deg. F. These tanks have been in service for 14 years and are now leaking. They are considered to be in poor condition and it is estimated they will be good for one more year of service.

Another pulp and paper mill reports as having six 10x11-ft. tanks made of spruce 2½ in. thick in the chests to beaters handling ground wood and sulphite pulp solution of 2 percent consistency at a temperature of 50 deg. F. These tanks have now been in service for three years and are in excellent condition.

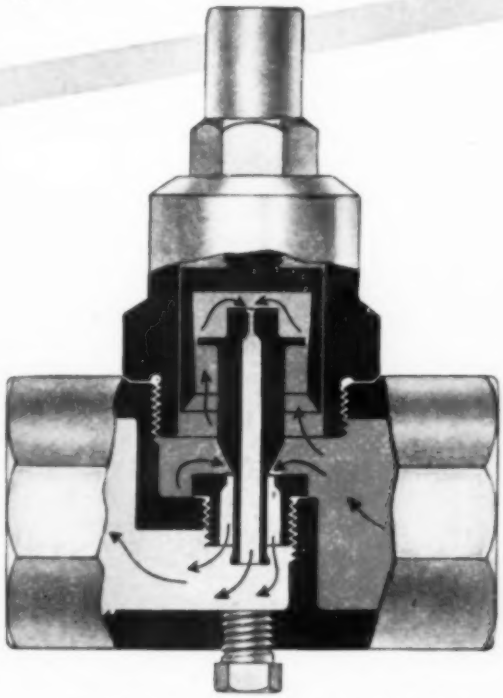
One pulp and paper mill operator wrote that he had installed one tank 12x10 ft. with a conical inner bottom. The tank was made of redwood 3 in. thick and handled pulp stock of 4 to 6 percent consistency at a temperature of 40 to 85 deg. F. The tank has been in service for three years and is in a good condition. He quotes: "This one redwood tank installed in a battery of other wood to determine truth of statement that coloring of redwood might leach out and discolor white pulp. No trouble of this kind was experienced and we would not hesitate using redwood because of any fear of discoloring tank contents."

A paper plant reports as having two 6x5-ft. tanks handling paper stock with alum acidity of pH 4.5 to 6.0 at a temperature of 70 to 115 deg. F. These tanks are made of redwood 2 in. thick. The tanks are not lined and have been in service for more than two years.

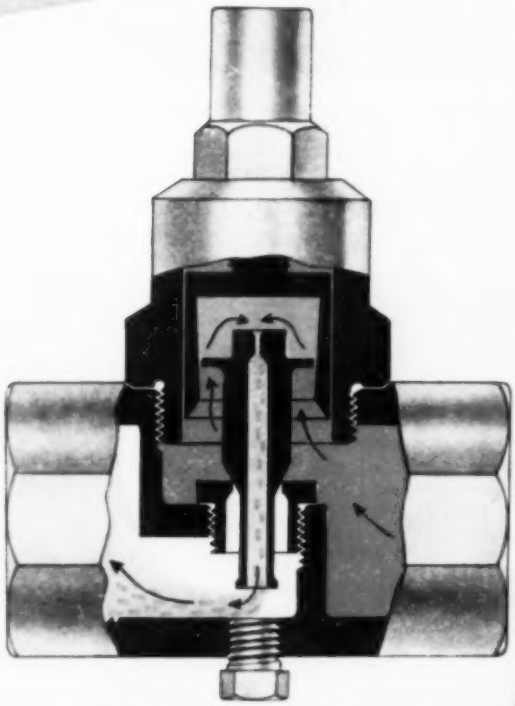
Another operator reports a tank 22x26 ft. made of Douglas fir 6 in. thick. This tank handles sulphite cooking acid (5 percent total, 2 percent combined) at temperatures up to 85 deg. F. This tank was in service for twelve years and due to acid attack and general disintegration in which the

WHY YARWAYS GET EQUIPMENT

Hotter, Sooner



VALVE OPEN—Main flow through seat.



VALVE CLOSED—Main flow shut off.

There's a basic reason why the Yarway Impulse Steam Trap gets equipment hotter, sooner . . . and *keeps it hot.* It's this . . . As soon as steam is turned on, the Yarway trap opens wide and discharges air and condensate continuously until the system is cleared. Equipment is brought to working temperature in the shortest possible time.

Once working temperature is reached, Yarways discharge intermittently to *keep* equipment at peak performance. Under very light condensate loads, discharge is small and continuous through control orifice, and main valve does not lift. *There is no wasteful steam leak,* since a mere 3% of full condensate capacity keeps control orifice completely sealed against discharge of live steam.

No wonder more than 525,000 Yarways have already been sold. They not only speed production . . . but also produce substantial operating economies.

Other Yarway advantages—*small size, easy maintenance, low price.* For full description and operating details of the Yarway Impulse Steam Trap write for Bulletin T-1739.

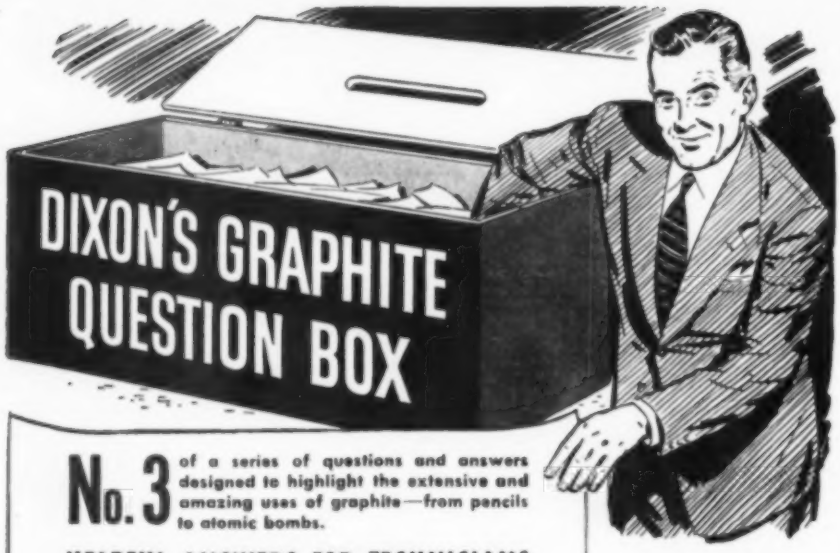
Try some Yarways today. See your nearby Mill Supply Dealer.

Yarway color motion picture, "There is an Engineering Reason." Available without charge for group showing. Write today.

YARNALL-WARING COMPANY, 137 Mermaid Ave., Phila. 18, Pa.

Yarway Impulse Steam Traps are now made and sold in Canada and Great Britain

YARWAY IMPULSE STEAM TRAP



No. 3 of a series of questions and answers designed to highlight the extensive and amazing uses of graphite—from pencils to atomic bombs.

HELPFUL ANSWERS FOR TECHNICIANS AND PRODUCT ENGINEERS

QUES. Is graphite processed into all required forms and shapes that make it usable for innumerable manual, mechanical, chemical and electrical applications?

ANS. Graphite owes its remarkable versatility to its almost unlimited scope of form and formulation. It is available in a wide variety of microscopic powders, large flakes, fluids, non-fluids, concentrates, bars, tubes, sheets, plates and specially processed shapes.

QUES. What are *some* of the products or processes in or on which graphite is used? (*Continued from No. 2*)

ANS. Suspensions and concentrates
Pressure pad lubricant for belt type sanding machines
Penetrating and rust dissolving lubricants
Stop cock lubricants
House movers' lubricant
Lace machine lubricant
Boiler water-scale conditioner
Miscellaneous grease, oil and aqueous lubricants
Miscellaneous grease and oil compounders' graphites
Miscellaneous lubricants of special structures, densities and shapes
Gunpowder glazing and pelleting
Glass makers' lubricants
Ferry rack lubricants
Synthetic rubber tire tube lubricant
Auto under-chassis spraying lubricant
Auto spring and shackle lubricant
Miscellaneous marine engine and equipment lubricants
Miscellaneous aircraft lubricants

On Railroads:

Brake cylinder lubricant
Triple valve lubricant
Curved track lubricant
Centerplate lubricant
Diaphragm, chafing plate and pedestal plate lubricant
Pantograph shoes
Hub liner lubricant
Driving spring lubricant
Cup and driving journal lubricant
Semaphore lubricant
Car seat and window slide lubricant
Engine front and jacket finishes

(*To be continued in No. 4*)

A few of thousands of widely used products containing Dixon's Graphites. Those starred are Dixon's products, many of them sold by supply houses everywhere.

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Brake Linings

★ Cup Grease No. 3

Now may we receive *your questions* on how graphite can help *you*?

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LOOK FOR No. 4
in this series. We will gladly send you reprints of any you may miss

top went first, it was replaced at the end of that time.

Jenssen acid absorption towers have at times been constructed from wood. The life of the wood Jenssen towers may be 20 years. The general practice is to build Jenssen towers from concrete. It is a matter of choice and opinion of the operator of a particular mill as to whether or not to use wooden tanks as concentrating and recovering tanks. These tanks may be operated under slight pressure, but their life is generally less than for acid storage tanks.

Another common use of woods in the sulphite mill is in the blow pits. These tanks are subjected to relatively weak sulphite acid solutions for a short period of time. Thus, their life may be 20 years. Decay from the outside may do more damage than chemicals within. The ducts from the blow pits to the vomit stacks and the vomit stacks themselves are usually made from wood. These constructions are subject to the action of moist, dilute sulphur dioxide, and life is 15 to 20 years. The damage, if any, may be due to dilute sulphuric acid formed from the sulphur dioxide under the moist, oxidizing condition. Dry sulphur dioxide gas is not encountered in a sulphite mill, although wooden construction would be expected to be resistant to this chemical.

CARBON and GRAPHITE

L. C. WERKING
National Carbon Co.
Cleveland, Ohio

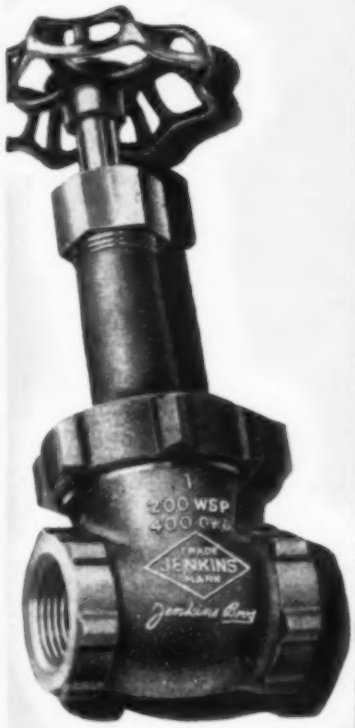
THERE is no evidence of corrosion of either carbon or graphite by sulphurous acid or by sulphur dioxide in any concentration below its dissociation temperature. In those cases where SO_2 is associated with free SO_3, or with air at temperatures exceeding 610 or 800 deg. F., carbon and graphite respectively, may be expected to react as they would with those reagents alone.

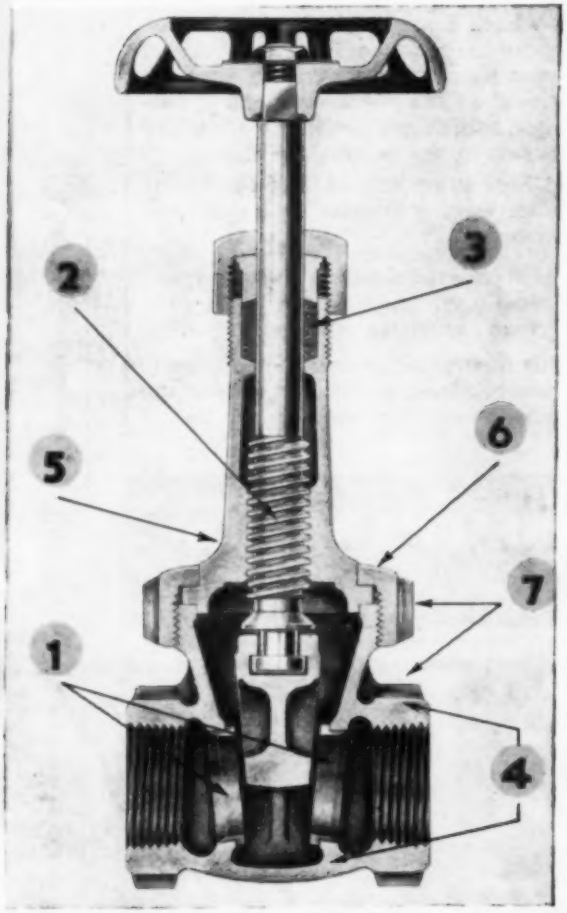
The corrosion characteristics of Karbate products (impervious carbon or graphite), are similar within the operating temperature limitation, 340 deg. F., on the material itself.

Outstanding evidence is to be found in the use of carbon and graphite elements in wet flue gas scrubbers for powdered fuel boilers where, after approximately ten years of service, no corrosion has been found in spite of conditions varying from dry to water saturation and the presence of air and combustion gases. Over periods of years no attack is evident in calcium bisulphite solutions saturated with SO_2 (sulphite liquor in paper mills) at temperatures of 300 deg. F. Graphite

IT'S *NEW* . . . IT'S *FAR AHEAD* — IN *DESIGN*-IN *DURABILITY*

JENKINS FIG. 270-U BRONZE GATE VALVE





1. "MONEL" SEAT RINGS EXPANDED IN BODY The seat rings, expanded into place in the body, are equivalent to integral faces. The "MONEL" metal used is about 2½ times the hardness of valve body bronze—provides exceptional resistance to erosion and corrosion.

2. LARGE SPINDLE THREADS LAST LONGER The threads on the traveling spindle are exceptionally long and large in diameter. This reduces wear to a minimum and insures easy operation. Spindle metal is hard, tough manganese bronze.

3. DEEP STUFFING BOX—MORE PACKING Deeper than most 200 lb. gate valves, it holds more packing. Keeps stuffing box tight around spindle with less friction, and permits spindle to be turned with less effort.

4. LIBERAL BODY DIMENSIONS ADD STRENGTH Made of 35,000 lb. tensile strength cast bronze—has full length of pipe threads and liberal clearance between threaded ends and diaphragm wall. Union assembly reinforces and strengthens body neck.

5. EXCEPTIONALLY RUGGED BONNET Projection on bottom assures snug fit into neck of body. Large diameter Acme threads, with long bearing, assure improved wear resistance. Machined bevel on underside matches beveled shoulder on spindle for back-seating under pressure and protecting spindle threads when valve is wide open.

6. HEAVY BONNET RING Union Bonnet joint withstands exceptionally high hydraulic pressures. Liberal thread engagement assures assembly that can be made tight and kept tight after repeated disassembly.

7. BODY AND BONNET RING LUGS Rugged sturdy lugs of novel design on body ends and bonnet ring permit repeated application of conventional wrenches.

AGAIN JENKINS PRACTICAL ENGINEERING SETS THE STANDARD FOR VALVE ECONOMY

• *IF ANY PART of the seating combination is to eventually need replacement, why not have it the most accessible part—the wedge rather than the seat? It's easier, quicker, cheaper to slip on a new wedge, than to install a new body!*

That's the principle on which Jenkins Engineers designed the new Fig. 270-U Bronze Gate Valve, with a high-quality bronze wedge seating against MONEL seat rings expanded in the body. With this sensible design, the wear affects only the most accessible part—the bronze wedge—which can be replaced by simply slipping it off the stem and slipping on a new one. Prolonged tests, in toughest service, prove it the best seating combination to beat wear, reduce care.

This new, better Fig. 270-U will give you unequalled economy in any service requiring a 200 lb. pressure Bronze Gate, and especially under severe conditions, such as in oil refineries, dye houses, chemical, food, and rubber plants.

WRITE FOR THIS FOLDER

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Types, Sizes, Pressures, Metals for Every Need

JENKINS BROS., 80 White St., New York 13
Send Bronze Gate Valve Folder.

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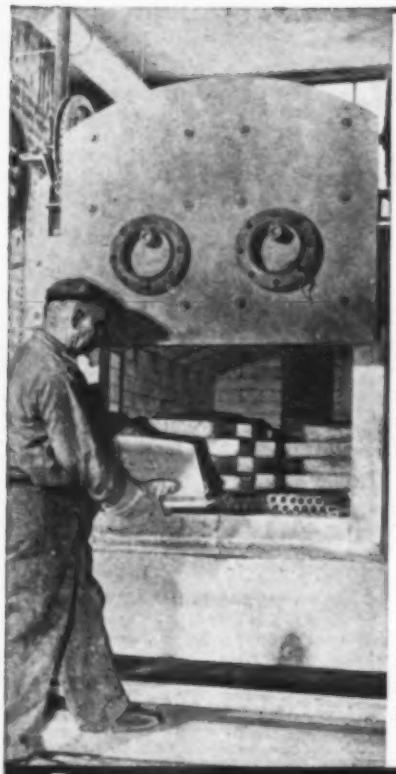

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To back up Amersil's research program to produce silica and quartz ware that lasts longer, we have installed at Hillside an annealing furnace which we believe to be the largest in any silica ware plant.

That annealing adds to the life of silica ware is attested by a customer who writes:

"Annealed Amersil silica trays last a minimum of ten times as long as those not annealed."

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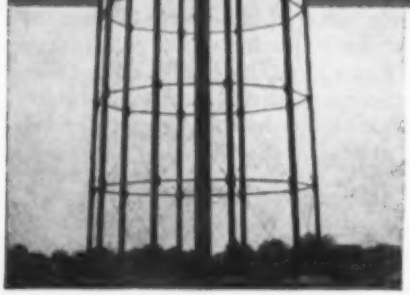
COLE TANKS



• For over 80 years, we have been furnishing industry and municipalities with dependable elevated steel tanks. We design, fabricate, and erect, in capacities from 5,000 to 2,000,000 gals., with hemispherical, ellipsoidal, or conical bottoms.

Write for prices, stating capacity, height to bottom, and location.

R.D. COLE MFG.CO. ESTABLISHED 1854
Newnan Ga.

bubble caps and trays are used in columns handling SO_2 plus low concentrations of H_2SO_4 subject to occasional neutralization by sodium hydroxide. Porous carbon is used for the dispersion of SO_2 containing low concentrations of SO_3.

For all practical purposes, carbon, graphite and Karbate may be used as, or in, all types of equipment subject to sulphur dioxide and sulphurous acid in all concentrations without fear of corrosion.

GLASS-LINED STEEL

O. I. CHORMANN
The Pfaudler Co.
Rochester, N. Y.

STANDARD glass-lined steel reactors are used for reactions involving sulphur dioxide gas, wet or dry, and sulphurous acid, with satisfactory results and service life. These reactors are one-piece, welded glass-lined steel units conforming to Code requirements, and have a very highly corrosion resistant glass coating. The units are equipped with glass coated agitator and baffles.

The capacity, jacket and internal pressure range of the standard units are as given in the following table.

Capacity, Gal.	Max. Working Pressure, psi. Jacket *	Tank Proper
350–1,000	90	50 and 125
500–1,250	90	50 and 125
1,250–2,000	85	50 and 150

* Jacket pressure reduced 15 psi. if vacuum in inner tank.

There is another type of glass-lined steel equipment that is quite extensively used as reactors involving sulphur dioxide gas, wet or dry, and sulphurous acid. This type of reactor differs from the above type, in that the top head is clamped-on, thereby allowing greater latitude in type and size of glass coated agitator that may be required for any given set of conditions. These units may likewise be equipped with glass coated baffles when specified. The glass-lined steel reactors of this type are limited as to working capacity and pressure due to design and manufacturing limitations. The capacities and allowable working pressures for this type of reactor are given in the following table.

Capacity, Gal.	Max. Working Pressure, psi. Jacket *	Tank Proper
50–100	75	38
100–200	75	34
150–300	75	28
500	75	22

* Jacket pressure reduced 15 psi. if vacuum in inner tank.

If neither type of reactor meets the operating conditions under consideration, then complete operating details should be submitted to the manufacturer for his recommendation.

FROM THE LOG OF EXPERIENCE

Dan Gulleben, ENGINEER

Magnus Swenson

MAGNUS SWENSON'S MONUMENT (at least one of them) is the great plant in the Chicago suburb of Harvey, now vigorously administered by G. E. Seavoy under the style of Swenson Evaporator Company. "Multum in parvo" would be the chemical engineer's disideratum but his skill is usually taxed by the opposite condition. A hundred years ago Rillieux, the famous Negro engineer of New Orleans, reduced the cost of removing water from sugar solutions from about a pound of coal per pound of water to three pounds of water per pound of steam, and presently a pound of coal can produce at least ten pounds of steam. Separation of water from solids is one of the fundamental unit operations of the chemical engineer and, if there were no cheap tool for this purpose, many valuable products thinly dispersed in water would not now be plentifully available. A sugar refinery in Switzerland is reported to obtain an evaporation of seven pounds of water per pound of steam. This is accomplished by re-compression of vapor by means of surplus hydro power.

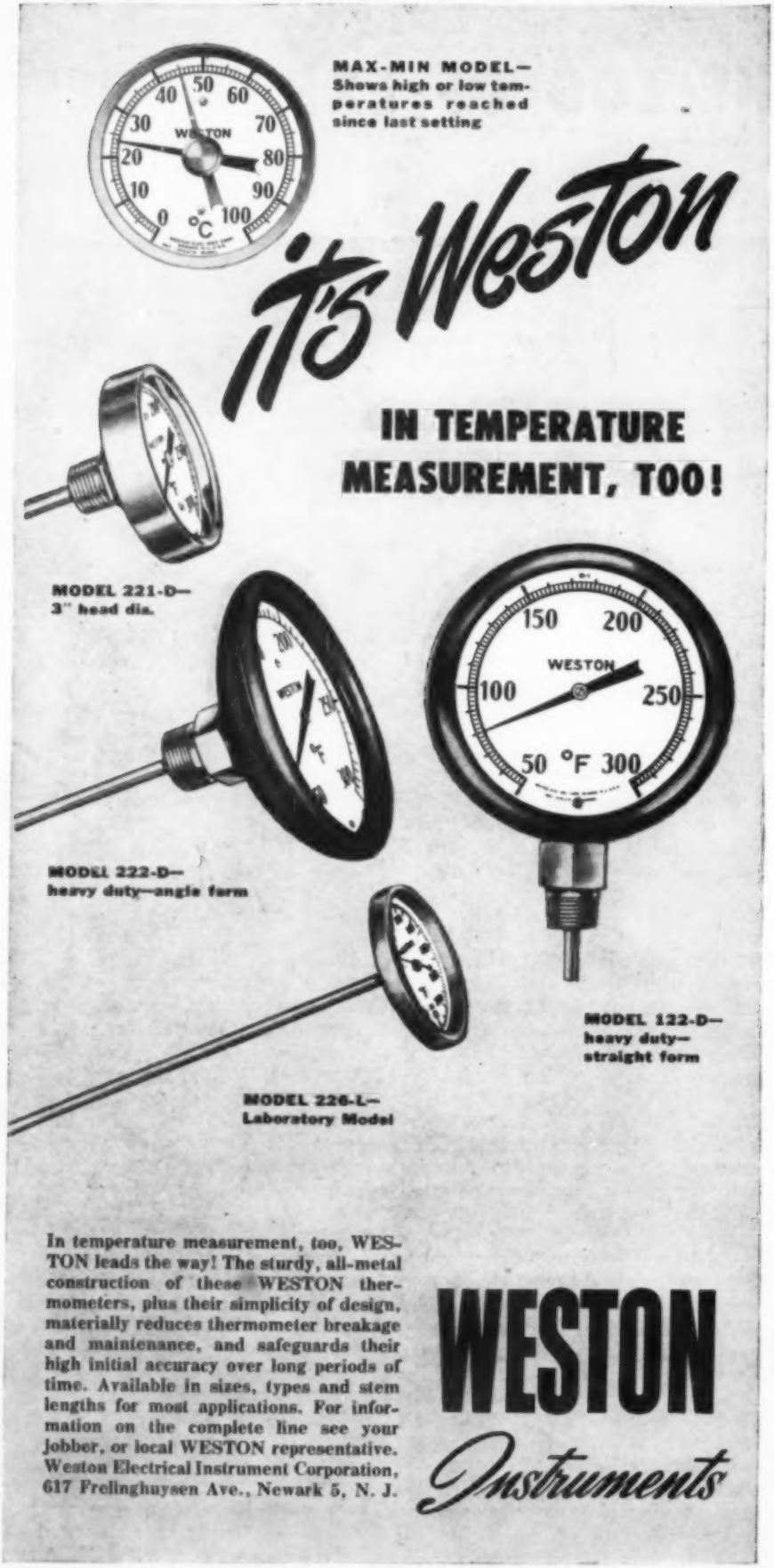
PRACTICAL APPLICATION of Rillieux's principles was one of the activities which Swenson promoted with great success. Even now the organization that he founded is outstanding in the production of equipment developed from his pioneering vision. And on the occasion of the chronicler's visit two years ago. Old Tom Taylor, who started as Swenson's shadow in 1887 at Fort Scott, Kansas, was still carrying forward the traditions at the Harvey shop. When Swenson went to Kansas from the University of Wisconsin he was followed by the title of "Professor," but Old Tom called him "Blacksmith," implying the method of his approach to machinery design.

SWENSON LEFT NORWAY in 1868 at the age of 14. His travels were recently made the subject of a fascinating record by his friend Professor Hougen of Wisconsin and from this some highlights are abstracted below. His father was a manufacturer of rope located at the port of Larvik. Schooner captains went out of their way to buy his dependable product. The transfer to America was accomplished aboard the small schooner "Victoria" in which 60 men, including crew and passengers, were packed for delivery to America. Every man was required to provide his own subsistance. Storms drove the craft into the Arctic. Dodging icebergs and tacking into the teeth of the wind stretched the cruise from the scheduled six weeks to twice that length. By the time the little boat reached Anticosti Island off the mouth of the St. Lawrence, 22 of the 60 had died of starvation and sickness and were buried at sea. Traveling by water and over land, Magnus reached destination at Janesville, Wisconsin, where he received a warm welcome at the hands of Uncle Paul Iverson, foreman of the blacksmith shop of the Northwestern Railroad. He got a job in Uncle Paul's shop and proceeded with dispatch to acquire proficiency in every branch of shop work, the while preparing himself by night study for entrance at the University of Wisconsin. On commencement day in the spring of 1875 he presented himself at Madison prepared to matriculate but was told to come back in September as college work does not commence on Commencement Day.

HIS HEAD AND MUSCLES collaborated in achieving a degree in mining engineering in '79. In his last summer vacation he and his classmate, Dick Aishton (later president of the Northwestern Railroad), got a job on a locating party in Dakota at the time when provisions and especially drinking water had to be foraged or brought along in covered wagons. Water was considered fit to drink when a stick thrust into it toppled over. This was also the period when Indians harassed the surveyors with prairie fires. The back flagman had to be convoyed by a detachment of U. S. Regulars to ward off an occasional arrow from an Indian's bow. One of Swenson's discoveries on this job was that the faithful pack mule followed Newton's law in respect to straight-line movement. He proceeded on a tangent with compass-like precision and his pacing, recorded by home made pedometer, checked the chainmen's measurements.

Back in college in the fall, Swenson got to work on his thesis, having selected the theme from his summer experience. The work covered an elaborate analysis of Madison's shallow-well water supply and the influence upon its quality by the nearby waste disposal pools. This created a political upheaval that won both praise and reproach. The popular excitement, however, brought about the construction of a new system of deep wells and a modern sewerage installation.

WISCONSIN ESTABLISHED its Agricultural College in 1880 with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Shows high or low temperatures reached since last setting
it's Weston
IN TEMPERATURE MEASUREMENT, TOO!
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In temperature measurement, too, WESTON leads the way! The sturdy, all-metal construction of these WESTON thermometers, plus their simplicity of design, materially reduces thermometer breakage and maintenance, and safeguards their high initial accuracy over long periods of time. Available in sizes, types and stem lengths for most applications. For information on the complete line see your jobber, or local WESTON representative.
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WESTON
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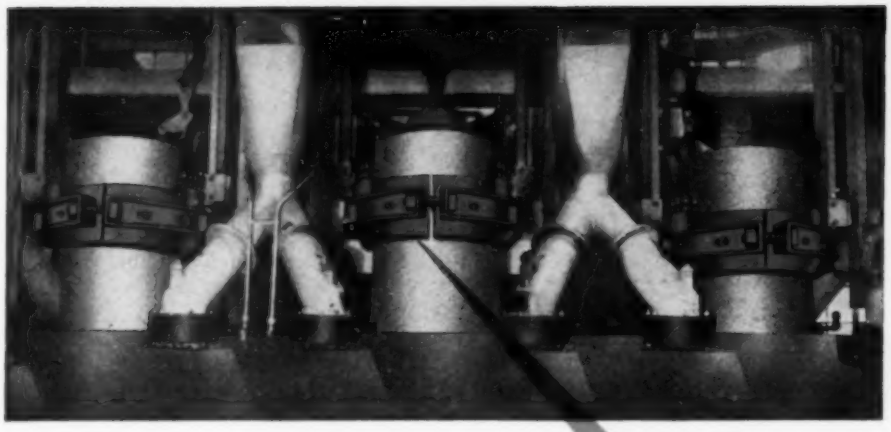
ROCHESTER · SAN FRANCISCO · SEATTLE · ST. LOUIS · SYRACUSE · IN CANADA, NORTHERN ELECTRIC CO., LTD., POWERLITE DEVICES, LTD.

Professor W. A. Henry, beet sugar pioneer, as dean at an annual stipend of $1,000. He appointed Swenson as the sole fellow member of the faculty and the salary was $1,200. The College's first research project was the culture of sorghum cane, which was expected to develop into a prolific temperate zone source of sugar. Certain farmers had been growing this cane in Wisconsin and it was furthermore cultivated in midwestern states, whither it had been brought from China 25 years earlier. This cane is more frost resistant than sugar cane. Its disadvantage as to glucose and organic acid content was expected to be removable by selective planting. It also had the disconcerting habit of producing seed simultaneously with sugar and thereby placing a heavy drain on the sugar content—as if the bee lingered in the hive during the working season to consume honey already stored in the comb. The college farm undertook a program of plant improvement and Swenson evolved processes and equipment for extracting the sugar. His thesis and progress report won the $2,500 prize of the U. S. Department of Agriculture. At this time, parenthetically, Swenson married his classmate, Anne Dinsdale, daughter of the local Methodist minister. He had met her for the first time at a farewell gathering in Winnequoh Park during his graduation festivities.

GREAT PUBLIC INTEREST attracted to the sorghum sugar project. A public demonstration was announced for the pilot plant and many Wisconsin legislators and other dignitaries came to learn of the mystery by which cane was converted into sugar. Unfortunately Swenson's mechanic had suffered a mental aberation in proportioning the drive of the centrifugal. The machine jumped to a speed of 4,000 rpm. and before Swenson could throw out the clutch the entire gallery of visitors was smeared with blackstrap. Much holiday apparel was ruined and Swenson himself left the factory unrecognizable under a shower of molasses. The performance made Swenson's position embarrassing.

OPPORTUNELY the great Col. Cunningham came up from Texas in his broad brimmed hat, offering the bait of the superintendency of his Sugarland mill (now Imperial Sugar Refinery). The Colonel was a confederate veteran of bold demeanor and impressive personality. When Swenson admitted that he had never been inside a full size sugar mill, the Colonel



3 N-B-M Electrode Holders applied to 40-inch carbon electrodes in a TVA 13,000 KW furnace unit producing phosphorus at Wilson Dam, Alabama.

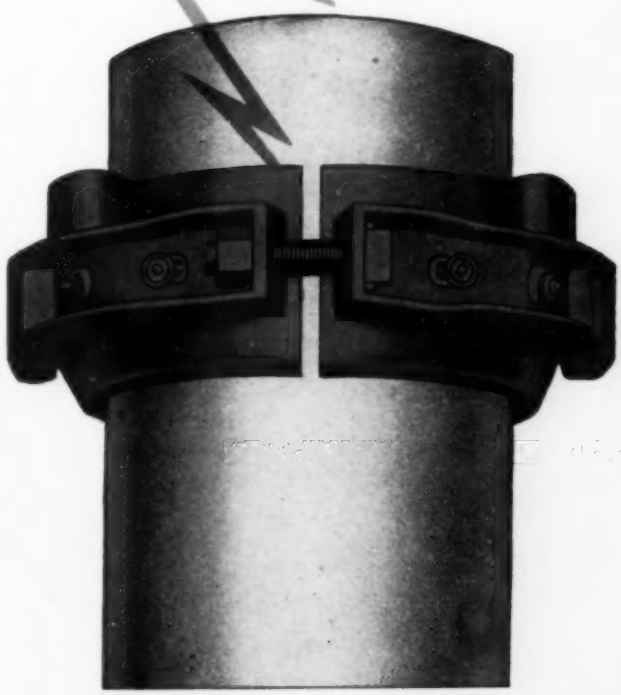
N·B·M ELECTRODE HOLDERS INCREASE CONDUCTIVITY... SAVE UP TO 500 KW

• Special copper alloy combines tighter gripping strength with higher thermal and electrical conductivity.

To overcome the wasteful resistance between holder and electrode, N-B-M has perfected an extremely dense, non-porous copper alloy. It permits tightest contact with maximum conductivity. All water-cooled castings are carefully tested under high hydrostatic pressure.

N-B-M Electrode Holders fit all types and sizes of carbon or graphite electrodes, for the production of phosphorus or carbide, in furnaces of low or high KW rating

Tell us your requirements—we can help you save substantially on power and maintenance costs.



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Tank Gauges

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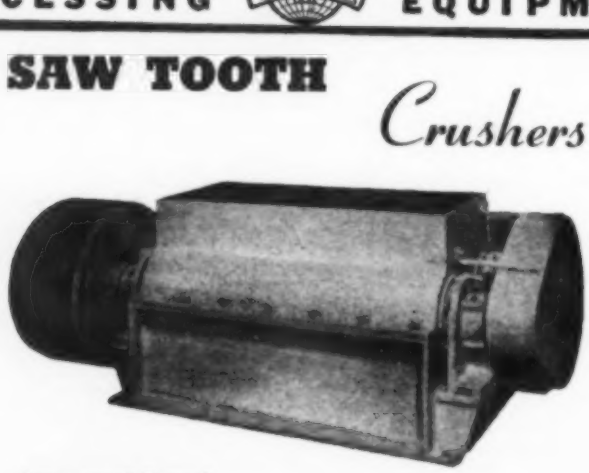
PROCESSING EQUIPMENT

SAW TOOTH
Crushers



Improved Type!

Rugged construction. Crushes material to finished size. Blades spaced to your specifications. Capacity from 3 to 15 tons. Roller bearing mounted shaft. Robinson Processing Equipment designed by engineers whose reputation is founded upon doing things right. Literature available. Inquiries invited.

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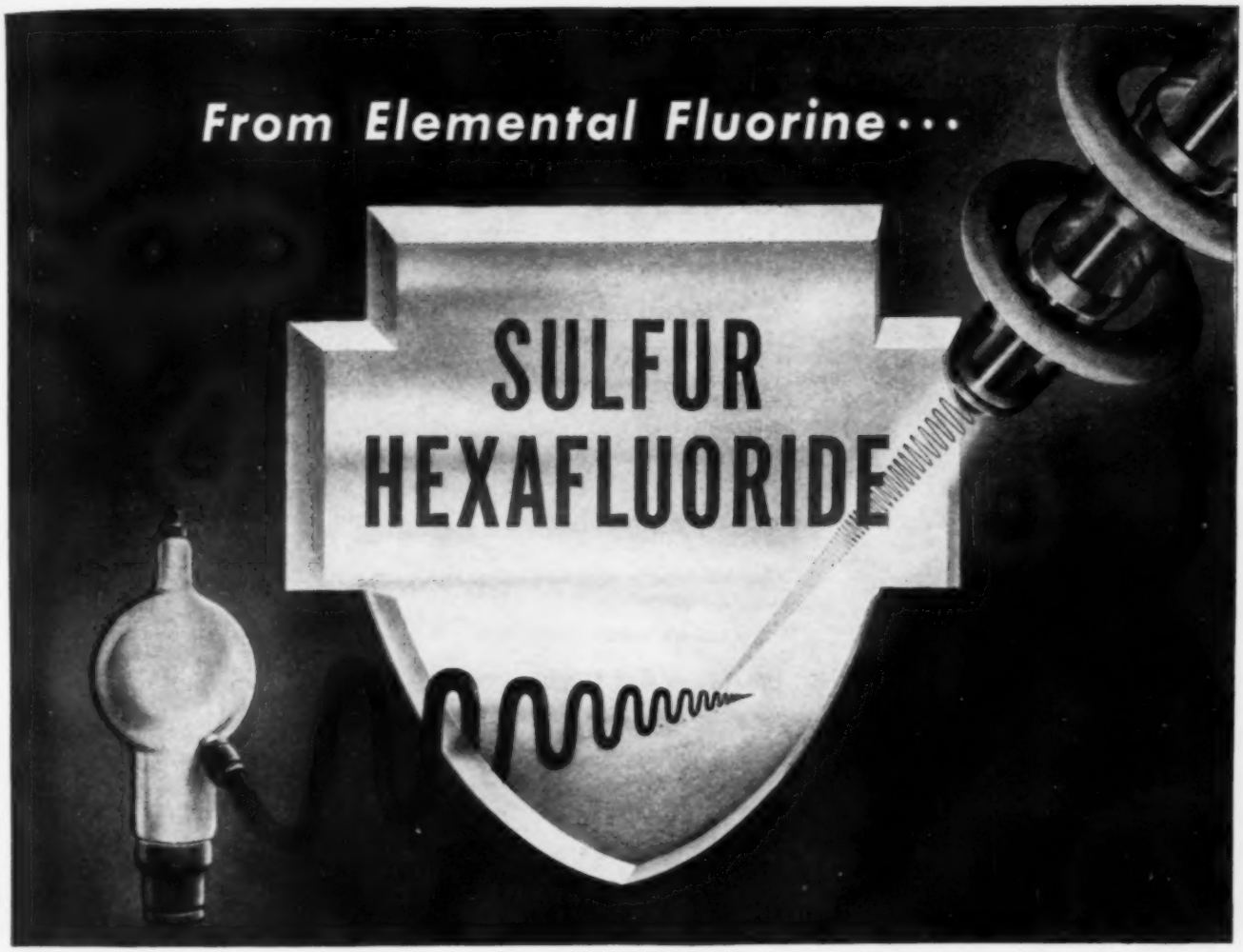
was amazed and asked him how it was possible that his process description could win the Agricultural Department's $2,500 prize. For the answer, Swenson referred him to the Department. The Texas offer was indeed an escape from his humiliating exhibition but Texas was not attractive to Swenson. At the suggestion of his wife he named a salary which he hoped would end the Colonel's importunity. The Colonel, however, only snorted and swore a great oath and then handed Swenson a check for $10,000 for his first year's salary and told him to come along. En route out of Chicago Swenson suffered harsh language from two of the victims of the sugar-making demonstrations whose clothing still exhibited indelible molasses stains.

FACTORY PERFORMANCE at Sugarland responded to Swenson's efforts and the yield of 100 lbs. of sugar from a ton of cane was doubled. However, Swenson could not acclimate himself to Texas either pathologically or sociologically. He contracted bone break fever. The standard home remedy was a certain concoction of black magic measured in a teaspoon for a white man, a tablespoon for a Negro and a cup for a mule. The plantation and mill were operated by Negro convicts under contract with the warden of the nearby state penitentiary. The principal Sabbath day sport was to release certain daring convicts, and after a handicap of six hours, send bloodhounds after them. The inducement to effort was freedom if they could escape the hounds. Few won the prize but some were lost in the swamps and had subsequently to be replaced to avoid mutilation of the sequence of numbers.

SWENSON RETURNED to Hutchinson, Kansas, where he had left his wife, having established acquaintance there in 1883 through a commission from Judge W. L. Parkinson in a project for sorghum sugar development. The U. S. Department of Agriculture became interested in sorghum and established an experimental plant in Ottawa, Kansas, where Swenson was employed for process and equipment design. He evolved a cutter, diffusion battery and a carbonation system of purification which promised success. In 1886 Judge Parkinson erected a plant in Fort Scott, Kansas, with Swenson as plant superintendent. The Department of Agriculture established an experimental station within the plant with G. L. Spencer as chemist, collaborating not only with his boss, W. H. Wiley, but also with Swenson



— A General Chemical Research Development +

SULFUR HEXAFLUORIDE

Formula: SF_6
Molecular Weight: 146.06
Melting Point: —50.8°C
Sublimation Temperature: —63.8°C
Critical Temperature: 45.6°C
Critical Pressure: 540 p.s.i.a.
Vapor Pressure:

Temp. (°C)	Pressure (p.s.i.a.)
—80	5
—50	34
—20	102
+10	240
+40	481

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FOR AMERICAN INDUSTRY

In Sulfur Hexafluoride, General Chemical Research makes another important contribution to fluorine chemistry. This stable dielectric gas is the first commercial chemical produced from elemental fluorine to be offered Industry . . . and fore-runner of many similarly-made fluorine compounds awaiting introduction.

Sulfur Hexafluoride was discovered by Moissan and Lebeau in 1900 as the product of combustion of sulfur in fluorine. It has been found to be remarkably inert and to possess exceptional thermal stability. These characteristics, together with its splendid electrical properties, have led to its present use as a gaseous dielectric in high-voltage equipment.

The physical data presented here may suggest other applications worthy of prompt investigation for your products and processes. For commercial quantities, experimental samples, or more detailed technical information, contact General Chemical Company, Research & Development Division, 40 Rector Street, New York 6, N. Y. Please use business letterhead when writing.

GENERAL CHEMICAL COMPANY
40 Rector Street, New York 6, N. Y.
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In Canada: The Nichols Chemical Company, Limited, Sun Life Building, Montreal, Quebec

2 STEPS in Cutting Costs of Handling Bagged Material

1 Install BAKER Fork Truck and Pallets

This will eliminate the back-breaking labor of handling individual bags manually, cut time and cost of car-loading or unloading, add storage space by tiering, and speed inter-department handling.

2 Get Suppliers to Palletize Shipments

This will cut time and cost of unloading incoming material. Supplier will make corresponding savings at shipping end with Fork Truck-Pallet combination. Damage in transit minimized.

Baker Fork Truck tiering pallet loads of bagged starch in storage. Note method of "locking" sacks to prevent side-slipping.

AT THE ERIE, PA. PLANT of one of our customers, raw materials such as clay, starch and talc, are received in bags. A typical carload will contain some 1600 bags, weighing about 50 lbs. each. These bags must be unloaded, stored, and transported to process departments as required.

This company took Step No. 1 years ago, and from the receiving point all bagged materials are carried in unit loads on pallets by fork truck. This has resulted in substantial savings each time the material is handled and has increased warehouse capacity by permitting high tiering. But bags not on pallets when they arrive must first be palletized—an operation requiring about 14 hours per car.

Step No. 2 is now under way. Arrangements are being made with all suppliers of bagged materials, to ship in unit loads, on pallets. Such carloads can be completely unloaded and stored in not much over two hours—as against 14 hours for palletizing alone. Since no individual man-handling of bags is required, heavy labor is eliminated, and damage from handling and shipping is minimized. Comparable savings are realized by suppliers at the shipping end, making it possible to improve deliveries.

Savings possible by complete palletization are demonstrated at the same plant in the case of shipping cartons. For these, which arrive in "knock-down" condition, the company furnishes the supplier with special four-way pallets—and the "flats" arrive in unit loads strapped to these pallets. Unloading and warehousing now takes about three hours per car, where formerly, when "flats" were received unpalletized, it took 24 man-hours for the job.

Let a Baker Material Handling Engineer show you how you can save money with fork trucks and pallets.

EITA

Members Electric Industrial Truck Association

BAKER INDUSTRIAL TRUCK DIVISION
of The Baker-Raulang Company
2145 West 25th Street • Cleveland, Ohio
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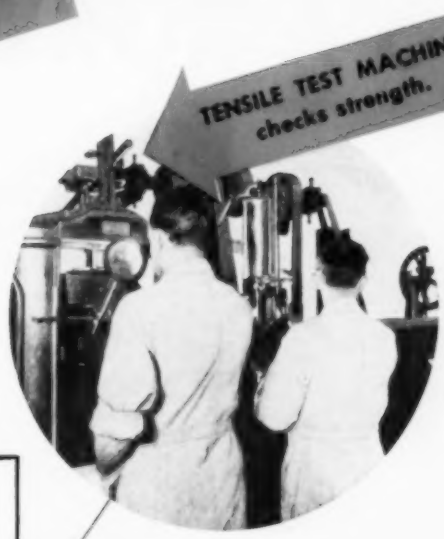
Baker INDUSTRIAL TRUCKS

and with Clifford Richardson, who later became famous as a petroleum chemist. Swenson applied for a patent on his carbonation process. This displeased Wiley who questioned the propriety of a Government employee applying for a patent, although Wiley himself refused to permit Swenson's device to be tried. He thought his own device of separating the sugar from impurities by solution with alcohol had a better chance of success. He feared public criticism and the possibility of discharge for failure to achieve success. The public press criticized the patent as hamstringing the industry. However, in spite of protests, the patent was allowed and thus established a precedent.

As time went on, Wiley developed great respect for Swenson's technological skill and frequently sought advice in respect to various chemical engineering perplexities. In 1901 he penned a request to Swenson for help on the development of his alcohol production patent, to wit, "I am anxious to develop this matter because I think it is a good thing, from an alcoholic and food side, and also because I want to make some money from it. I am getting old and I hate awfully to die poor and leave you to live rich. If we could both be poor or both be rich, it wouldn't matter, but as you are bound to be rich, I don't see anything I can do but to come up to your standards."

RAISING SORGHUM and building plants in Kansas grew with precipitate speed, especially under the munificence of the public treasury. Swenson was right in the midst of this movement. He acquired a half interest in the Fort Scott Foundry and Machine Company from owner Walburn and proceeded under the name of Walburn-Swenson Company to build a complete line of sugar machinery. By the time government bounties on home produced sugar ceased in '94, enthusiasm for sorghum culture had petered out. It was distressed by bad financing and management, difficult chemurgical problems and several bad fires. Around 1894 the entire activity was thrown overboard.

WALBURN-SWENSON MOVED its shops to Chicago in 1892. In anticipation of lean years in the demand for sugar machinery, Swenson added to the repertory a full line of cotton picking and processing machinery, garbage grease extractors, drum dryers, ore concentrators and even an experimental automobile built in 1897. He had taken out about 50 patents and barring the panic years of '92 and '93 the traffic returned a large profit. His cotton ginning and baling apparatus won



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★ **Uniform Metal Structure free from wall leaks.**

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★ A simple pipe fitting, installed and forgotten. If it bears the well known Grinnell "G", you may be sure every precaution has been taken so that you *may* forget it.

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WHENEVER PIPING IS INVOLVED

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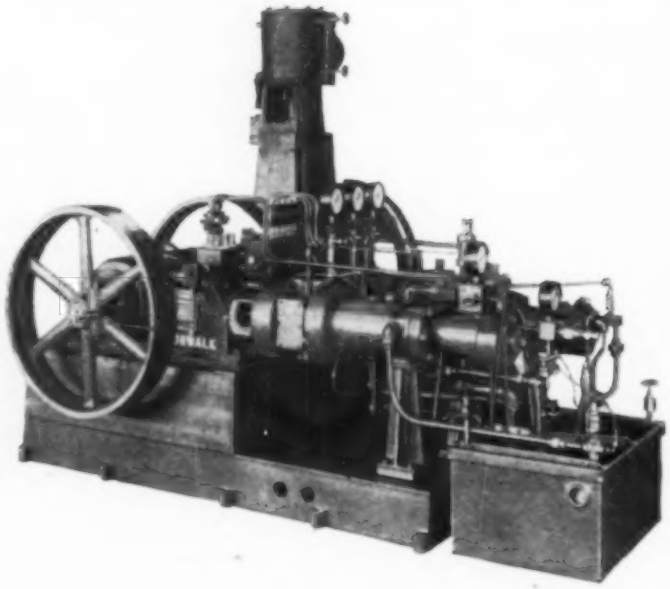

HIGH PRESSURE COMPRESSOR

Built by the Pioneers of the Industry

Illustrated is a heavy duty five stage compressor, SR-S5X, designed for pressures up to 20,000 pounds.

All stages are force-feed lubricated and water jacketed. Frames with taper roller main bearings are used on the smaller sizes. Valves are readily accessible.

By their very nature, compressors of this size are designed and manufactured in close cooperation with the customer's engineers. For additional data, write for Catalog No. 40.

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10 NORTH WATER STREET, SOUTH NORWALK, CONN.

Manufacturers of High Pressure Compressors for Air and Gases for more than 80 Years

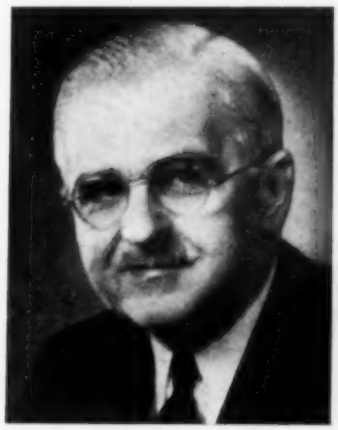
the Franklin Institute award. Among the patents there was an automatic relief valve possibly suggested by the wreckless operators of portable steam engines in the cotton fields who added a brick or two to the safety valve lever and then boasted that they were not cowards. Swenson promoted the slogan "Save the Waste." As consulting chemical engineer he elaborated extensive byproducts developments for Swift, Nelson Morris, Libby McNeil & Libby, Ligget-Meyers, Royal Baking Powder, Colgate, Procter & Gamble and many others.

SWENSON RETIRED in 1902 from manufacturing routine and moved back to Madison. He acquired a large tract of land on the shore of Lake Mendota and decorated it with trees from Norway, running brooks, flowers, fish and birds and then called it "Thorstrand" after his home town in Norway. He organized the Southern Wisconsin Power Co. and with Daniel W. Mead built hydro-electric plants. He served on directorates of various industries and became president of a Norwegian steamship line to provide the excuse for an annual journey to the homeland. To maintain connection with the old industry he even accepted the presidency of the U. S. Sugar Co., which built a beet sugar works near Madison. Furthermore he participated in civic activities as regent of the University of Wisconsin, Chairman of the Capital Building Committee, Member of the Great Lakes Navigation Commission, Chairman of the Wisconsin Council of Defense, Federal Food Administrator for Wisconsin and other affairs of public work. He assisted in the establishment of the college of chemical engineering at Wisconsin and collaborated vigorously with Wiley in promoting the Pure Food and Drug Act. On one occasion the Governor who had appointed him to the Board of Regents of the University requested him to remove Dean Henry from the faculty. No specific change was offered and so Swenson replied, "Then Henry remains and so do I." After the war he was sent to Finland to bring food to the starving Finns. Sixty percent of the children of Finland had died. He commandeered 14 shiploads of food supplies from America and then had some daring Finns, dressed in Bolshevik garb, capture a Russian ice-breaker to cut a path for the ships. However, he beat starvation and won the everlasting gratitude of the Finns. His last years were spent at Thorstrand with frequent visits from his four daughters and their families. Mrs. Swenson died in 1935 and Magnus followed early the next year at the age of 81.

NAMES IN THE NEWS

F. R. Lowdermilk

R. L. Pigford



R. T. K. Cornwell

Ford R. Lowdermilk has been appointed supervisor of the development division in the research and development department of the Pennsylvania Salt Manufacturing Co. He replaces **Frank R. Murphy,** who recently became assistant production manager in Pennsalt's manufacturing department. Before joining Pennsalt, Lowdermilk was associated with the Barrett division of the Allied Chemical and Dye Corp. in the research and development department and as technical assistant to the chief chemical engineer.

Fred W. Jensen has been appointed head of the department of chemistry at Texas A. & M. College. He succeeds **C. C. Hedges,** head of the department for 34 years and who has resigned from administrative work but will continue to teach.

A. Lloyd Taylor has accepted the post of research supervisor with Wyandotte Chemicals Corp., Wyandotte, Mich. His work will be in the field of industrial detergents and related materials. Taylor was formerly vice president in charge of research and development with H. L. Shaw and Sons, Inc., of Portsmouth, N. H. and Boston, Mass.

Fred C. Bond has been made technical director in the basic industries department of Allis-Chalmers. **Will Mitchell, Jr.,** has been named director of the department's research laboratory, while **Bruce H. Irwin** becomes assistant laboratory director and director of training for the department.

Robert L. Pigford, research engineer for the Du Pont Co. in Wilmington, Del., and veteran instructor of graduate courses in chemical engineering under the University's extension division, has been announced as new head of the Department of Chemical Engineering at the University of Delaware. Joining the staff with the rank of full professor, Dr. Pigford replaces **Allan P. Colburn,** who has assumed new duties as assistant to the president of the University and adviser on research.

Wilbur F. Gillespie, of the Gaylord Container Corp., Bogalusa, La., has been elected unanimously to fill the unexpired term of the late **Worthen E. Brawn** as president of the Technical Association of the Pulp and Paper Industry. Election was by the executive committee as provided in the Association's constitution.

H. B. H. Cooper has been made an assistant manager of the development department, Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J. Prior to his present post, Cooper was divisional engineer of the rubber chemicals, pharmaceuticals and coal tar products refining divisions.

John W. Cornwell has been engaged by the Electrochemical Society as assistant secretary. A Dartmouth graduate, Cornwell spent three and one-half years in the Navy, studied radar and electronics, later served as radio materiel officer and assistant engineer aboard a destroyer.

Ralph T. K. Cornwell, director of research, Sylvania division, American Viscose Corp., has moved from Fredericksburg, Va., to Marcus Hook, Pa., where the research department of Sylvania division will be established. Cornwell was a member of the board of directors of Sylvania Industrial Corp.

Willis F. Harrington has retired as a member of the executive committee and also resigned as a vice president of E. I. du Pont de Nemours & Co., Inc., effective August 1. He will continue to serve as a member of the board of directors. **J. Warren Kinsman,** general manager of the company's fabrics and finishes department, and a member of the board, was made a vice president and member of the executive committee.

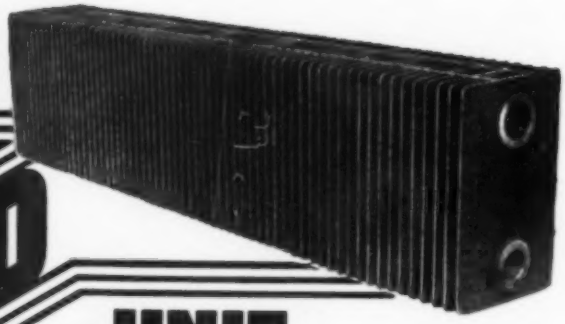
Robert D. Misch, 22, Whiting, Ind., graduate student at Illinois Institute of Technology, has been awarded the $1,000 Weston fellowship, made annually to the outstanding graduate student in electrochemistry in the United States and Canada, by the Electrochemical Society.

Edward M. McMahon of the Tennessee Eastman Corp., Kingsport, has been elected chairman of the Northeast Tennessee Section of the American Chemical Society.

Alan R. McFarland, newly appointed assistant to the vice president in charge of production at the Woburn Chemical Corp., Harrison, N. J., was prior to his appointment personal aide

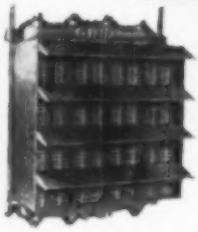
HERE'S WHY-

Trade Mark Reg. U. S. Pat. Off.



GRID UNIT HEATERS

HIGH TEST CAST IRON HEATING SECTIONS



WITHSTAND HIGH CORROSIVE FUMES OF HCl AND Cl_2

- One piece construction heating sections (Patented) of high test cast iron that will withstand steam pressures up to 250 lbs.
- No soldered, brazed, welded nor expanded connections to become loose or develop leaks.
- No electrolysis to cause corrosion, with resultant breakdowns, leaks or heating failures now, or in future years . . .

Capacity tables and engineering data upon request. Send for free booklet, "CORROSION IN UNIT HEATERS".

It's the material that makes the difference. GRID Unit Heaters withstand the high corrosive fumes of HCl, and Cl_2, and in many chemical plants they have been in continuous operation for over 17 years without maintenance expense.

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Help for your CHEMICAL STORAGE and PROCESSING PROBLEMS •

STAINLESS STEEL STOCK POTS

• Solve many of your storage and processing problems with these rust-proof, acid resisting, easy-to-clean Stock Pots.

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to Fleet Admiral E. J. King. McFarland held the rank of Commander in the Navy.

R. C. Gibson, formerly director of research, has been made technical director, taking complete charge of all laboratory, development and pilot plant operations at the Parker Rust Proof Co., Detroit, Mich. **Grant C. Bailey,** formerly with the research department of the Phillips Petroleum Co., Bartlesville, Okla., has been appointed manager of the research department, and **Gaillard W. Dell,** formerly with Bohn Aluminum and Brass Co., Detroit, has also joined the research staff of Parker.

W. Nelson Axe, who had been in charge of patent work in the research department, has been appointed supervisor of the lubricating oil research section for Phillips Petroleum Co. **Spencer S. Prentiss** has been made associate director in charge of patent affairs for the research department. Before joining Phillips, Prentiss was engaged in governmental patent work in the OSRD.

Phillip J. Maddex and **Warren E. Berry,** both Ohio State graduates, have joined the research staff of Battelle Institute, Columbus, Ohio. Maddex, formerly a chemical engineer with the Ken-Rad Tube and Lamp Corp., will study non-ferrous metallurgy, while Berry will concentrate on industrial corrosion problems.

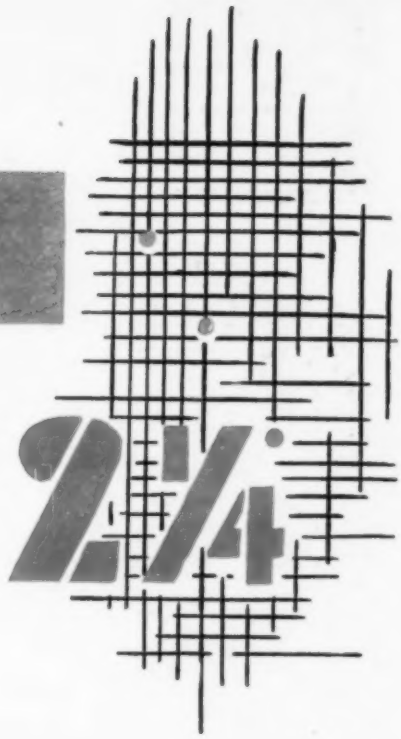
Fritz Fromm, professor of chemistry in the College of the Sacred Heart at Santurce, Puerto Rico, has been elected chairman of a newly chartered Puerto Rico section of the American Chemical Society.

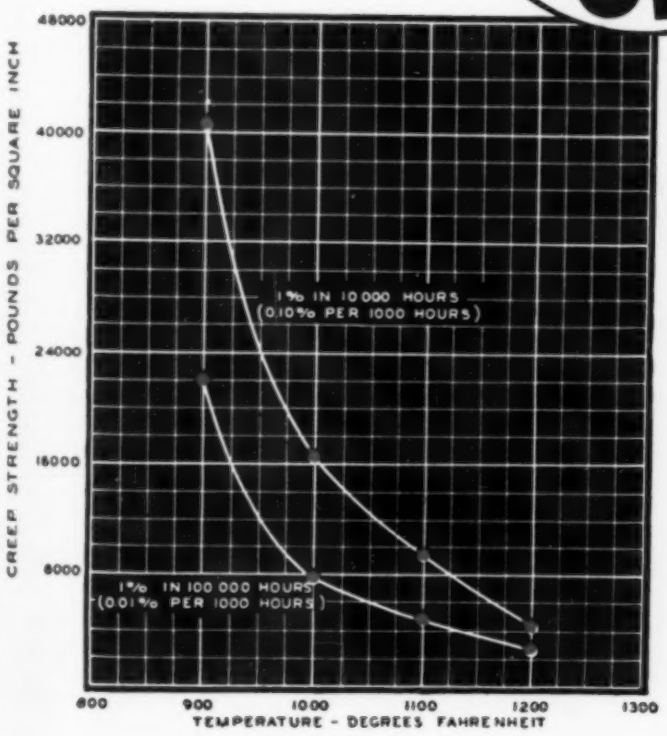
J. Davidson Pratt, general manager of the British Association of Chemical Manufacturers, has been awarded the Medal of Freedom, with silver palms, by the American government for exceptionally meritorious work and cooperation with the U. S. while controller of chemical defense development at the Ministry of Supply from 1940 to 1945.

Ralph J. Holtschlag and **Robert E. Howard** have been promoted to group leaders in the St. Louis research department of the organic chemicals division of the Monsanto Chemical Co. Holtschlag will be in charge of small-scale and interim production activities in the department, while Howard will be group leader of pilot plant activities. Holtschlag had been in the interim production department previously, and Howard had been a research chemist.

Sidney M. Cantor has become director of research for the American

Need tubing with high creep strength?





WHEN chemical processing operations call for tubing with extremely high resistance to creep, call on Croloy 2¼. This low-chromium B&W alloy has the highest creep strength at 1000 to 1200F of any alloy available below the more expensive stainless steel grades. Along with this outstanding property, Croloy 2¼ also affords good corrosion resistance in the range of services for which it is intended.

Large quantities of Croloy 2¼ are in service — paying substantial dividends in lower tube cost per year of service, increased throughput, reduced tube weight and greater safety.

You can Call on Croloy for the right answer to any other refinery tube problem, too.

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B&W

Seamless and Welded Tubular Products in a full range of Carbon, Alloy, and Stainless Steels for All Pressure and Mechanical Applications.

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Stationary and Marine Boilers . . . Boiler Components . . . Pulverizers . . . Fuel Burning Equipment . . . Refractories . . . Chemical Recovery Units . . . Process Equipment . . . Alloy Castings.

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"With me it's just work, work, work — particularly **WIRE WORK!**

"Just about every industry (it seems) knows about my large range of weaves, crimps, metals, mesh and wire sizes . . . and about my maker's extensive facilities for working me into baskets, machine and window guards, partitions, enclosures, strainers and reel covers."

ONE MINUTE I'M FRAMED

. . . but I know all the ANGLES . . . and CHANNELS. When you see me with a ROD, you know I've been framed. Naturally, I'm always on GUARD. (Buffalo Wire, of course).

NEXT MINUTE I'M FORMED

. . . into strainers or some specially ordered designs. My foundry work keeps me in RIDDLES all the time.

I'M EITHER WELDED

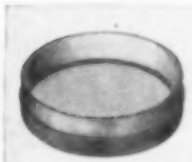
. . . into machine or window guards, partitions, baskets and strainers . . .

OR I'M SOLDERED

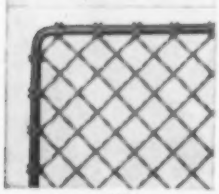
together with other wire cloth into big panels (reel covers).

OTHER TIMES I'M BOUND

. . . along the edges with webbing for screening and bolting machinery . . . or equipped with hook strips for vibrating screens. I'm BOUND to please.



WIRE PRODUCTS FOR EVERY NEED



Standard hand riddles are carried in stock. Gyratory bottoms, shaker screens, baskets, strainers, partitions, enclosures, window and machine guards are custom made. Write for free, illustrated literature.

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Manufacturer of All Kinds of Wire Cloth Since 1869

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Sugar Refining Co. Since 1943 he has been assistant director of research of Corn Products Refining Co.

Geoffrey Broughton, who had accepted a position as professor of chemical engineering at Illinois Institute of Technology, Chicago, Ill., will remain in Rochester, N. Y., because of the illness of Mrs. Broughton. He will remain with the Eastman Kodak Co. in the paper service department. His appointment at Illinois Tech was to begin September 1.

Andrew P. Dunlop has been given the assistant directorship of chemical research for the Quaker Oats Co. A Quaker employee for 16 years, Dunlop has worked on development of furfuryl alcohol and furoic acid. He has also helped to improve furfural, from which du Pont will soon be making Nylon at a new plant in Niagara Falls, New York.

John H. Schaefer, vice president in charge of manufacturing and transportation for Ethyl Corp., has transferred his headquarters from New York City to Baton Rouge, La., to supervise the company's operations there.

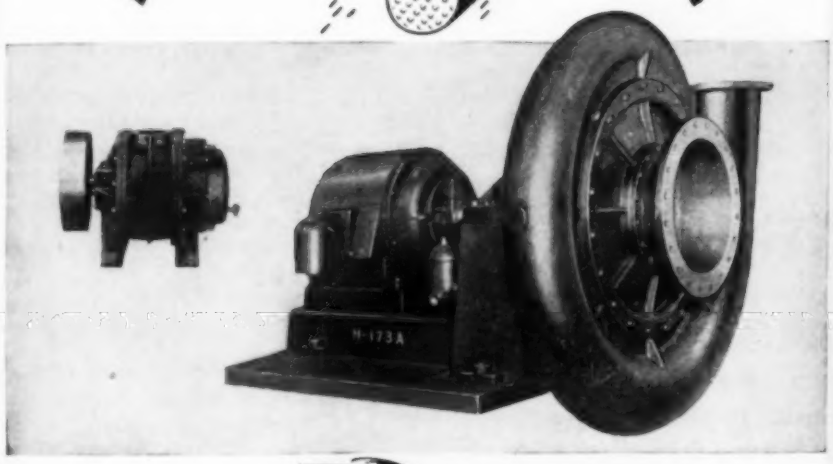
Elgin S. Nickerson has been appointed general manager of the fabrics and finishes department of E. I. du Pont de Nemours & Co. Nickerson, who was assistant general manager of the department, succeeds **J. Warren Kinsman,** who recently became a vice president and member of the company's executive committee. In other appointments **H. H. Hopkins** was made assistant general manager of the fabrics and finishes department; **Matt Denning,** manager of the finishes division; and **M. A. Dibble,** assistant manager of the finishes division.

George B. Murphy is now an assistant professor of chemical engineering at Clarkson College of Technology, Potsdam, N. Y. He teaches design and principles to chemical engineering seniors. Head of the departments of chemistry and chemical engineering is **Charles Hecker,** who was formerly with Rohm & Haas.

Matthew Van Winkle has received an associate professorship in chemical engineering at the University of Texas, Austin. He comes to Texas from the University of Michigan. He is the author of the book "Aviation Gasoline Manufacture."

Reginald Rockwell, who has spent most of his 25 years with the company in production of rosin and terpene chemicals, has been elected to the board of directors of the Hercules

A THIMBLE OF AIR...



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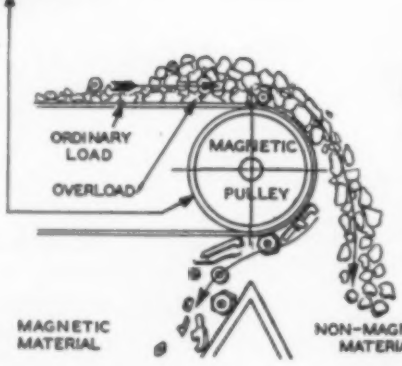

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CLUTCHES
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MAGNETS

Powder Co. Previously he was general manager of the paper makers chemical department.

R. A. Bondurant, Jr., has been elected a vice president of the Michigan Chemical Corp., St. Louis, Mich., having served the company since 1943 as technical director. He is a graduate of Virginia Polytechnic Institute.

W. D. McElroy has become manager of the development department of the Research & Development Division of Pittsburgh Consolidation Coal Co., Library, Pa. He was previously general superintendent of the United Gas Improvement Co.'s Ugite plant No. 2, Chester, Pa. McElroy will be in charge of pilot plant operations in the coal gasification program.

William L. Bruckart, former Naval officer, has joined the staff of Battelle Institute, Columbus, Ohio, where he will be associated with its division of corrosion research. Bruckart attended Massachusetts Institute of Technology, Bowdoin College and the University of Kentucky. Prior to his appointment to the Battelle staff, he was an engineer for the Southern Liquid Gas Co., Dothan, Ala.

R. N. Giles, superintendent of technical service in the Whiting, Ind., laboratories of Standard Oil Co. (Indiana), has been promoted to director of technical service with headquarters in the research department at the general office in Chicago. He will be responsible for direction of technical service activities at all of the Standard of Indiana refineries. Giles joined the Standard Oil in 1930 after graduate work at Ohio State University. **C. R. Harte**, assistant superintendent of technical service at Whiting, succeeds Giles. Harte joined the company in 1936, after graduate work at the University of Michigan and several years in industry.

William D. Schaeffer has joined the research and development staff of Godfrey L. Cabot, Inc., carbon black manufacturers of Boston, Mass.

Warren H. Goss has resigned as chemical engineer at the Northern Regional Research Laboratory to become a member of the research staff of Pillsbury Flour Mills. He will work in the soybean development program.

Harry E. Hartzell, named operating assistant for the cellulose products department, Hercules Powder Co., Wilmington, Del., will transfer there from Hercules' Parlin, N. J., plant, where he has been cellulose acetate superintendent. **Arthur A. Swanson**,

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to have around . . .

Yes, indeed—Chase Bags are mighty good to have around your products—whatever they may be. *Good* because they're designed to best meet your packaging requirements.

Chase has had one hundred years of engineering experience in designing containers of all types—cotton, burlap, paper, open mesh, and waterproof bags for the extra protection of hard-to-carry, dry and wet products.

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OKLAHOMA CITY • ORLANDO, FLA. • PHILADELPHIA • PITTSBURGH • PORTLAND, ORE. • REIDSVILLE, N. C. • ST. LOUIS • SALT LAKE CITY • TOLEDO

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of the Parlin, N. J., plant laboratory staff, has become a plastics technical service representative. **Robert Wier, III**, of the Hopewell, Va., plant, has been named an assistant product supervisor on CMC, sodium carboxymethylcellulose.

Louis Koenig is new chairman of the Chemistry and Chemical Engineering Department of the Armour Research Foundation of Illinois Institute of Technology, Chicago, Ill. Koenig was previously chief of the research branch of the United States Atomic Energy Commission, New York.

Dimitry S. Troubs, named coordinator of manufacturing operations of the industrial chemical sales division of West Virginia Pulp and Paper Co., will direct chemical manufacturing operations in the company's six plants at Covington, Va.; Charleston, S. C.; Tyrone and Williamsburg, Pa.; Mechanicville, N. Y.; and Luke, Md. Troubs has been directing operations of the division at Covington, Va.

OBITUARIES

Frederic W. Willard, 66, recently retired president of the Nassau Smelting & Refining Co., Western Electric subsidiary, and prominent chemical engineer, died in his Summit, N. J., home on August 11.

Arthur LaMotte, 76, former manager of the technical service section of the du Pont Company's explosives department and a pioneer in the development and industrial application of commercial explosives, died at the home of his nephew in Oakland, Calif., on July 18.

J. Carroll Kennedy, vice president of the Kennedy Valve Mfg. Co. for 20 years and one of the sons of the company's founder, died June 23 at St. Joseph's Hospital, Elmira, N. Y., a few days after an operation.

Lester O. Stearns, residential division sales manager of York-Shipley, Inc., died of a heart attack August 1 while at work in York, Pa. He was 53 years of age.

Clarence H. Barnes, 37, chief control chemist at the Drackett Co., a native of Cincinnati, was fatally injured in an auto accident on August 1 in Amberley Village, Ohio.

Safford K. Colby, 74, vice president in charge of research and advertising for the Aluminum Co. of America, died suddenly of a heart attack in Pittsburgh August 4. A pioneer of the aluminum business, he has been associated with Alcoa for more than 51 years.

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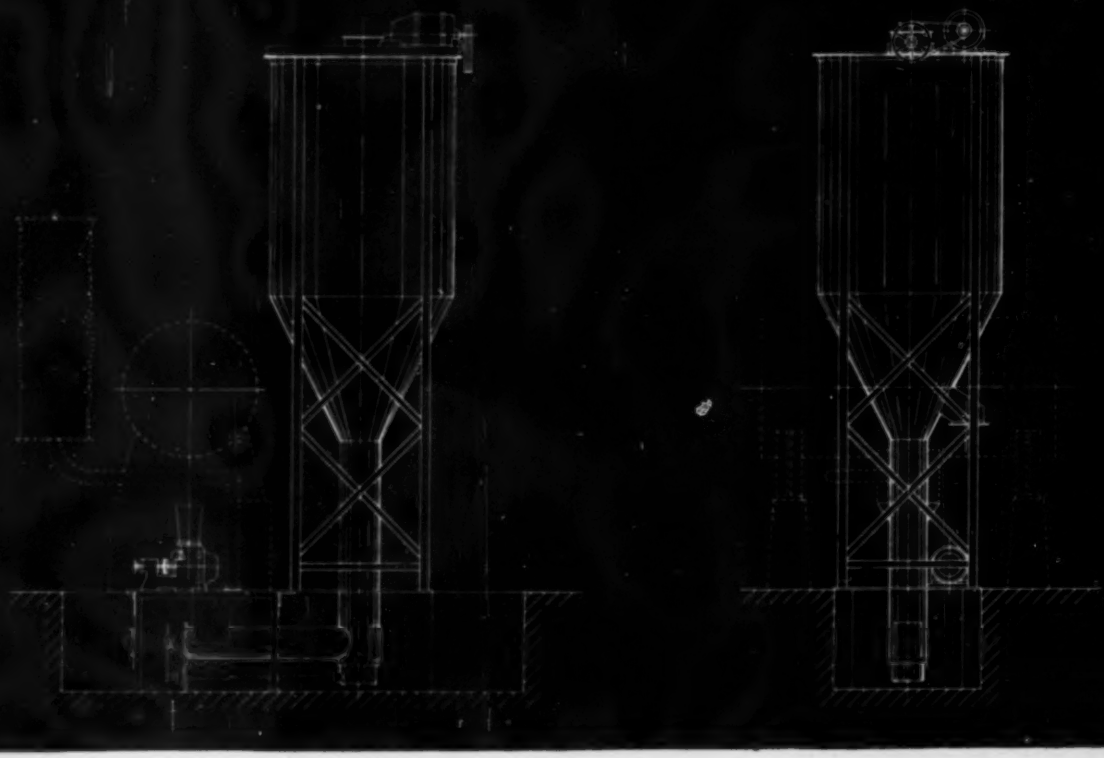

PROBLEM: In many chemical processes, the fluctuating characteristics of the product often interfere with the required uniformity. This is true especially where batch reactions are involved.

A large manufacturer of organic dyestuffs had such a problem . . . solved by Sprout-Waldron ADAPTIONEERING.

SOLUTION: Our engineers designed an installation — one unit of which is shown above — a battery of four 150 cu. ft. vertical mixers coupled with four 12 inch disintegrating mills. So satisfactory was our recommendation that subsequently the original installation has been doubled.

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1. An adequate reservoir is provided to insure inter-batch uniformity at all times.
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3. Minimum floor space is required.
4. Extra economy. A battery of these units can be assigned as a reserve for individual formulas, eliminating cleaning and the possibility of cross contamination.

This same approach has proved the ideal solution in a number of unrelated situations. It has been particularly valuable in several installations where comparable reservoirs with capacities up to 375 cu. ft. are blending successive batches of a granular product, such as glue chips and thermo-plastic stocks.

If your problem involves size reduction, mixing or blending, size separation or classification, or the handling of materials in bulk, you may realize considerable savings by consulting Sprout-Waldron. Our valuable ADAPTIONEERING service — ingenuity + machines + experience — is at your command.

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INDUSTRIAL NOTES

R-S Products Corp., Philadelphia, has promoted David W. Hopkins to executive vice president with full administrative authority in the valve, furnace and manufacturing divisions.

Carbomatic Corp., Long Island City, N. Y., has moved its headquarters to 24-81 47th St.

Atlas Powder Co., Wilmington, Del., has established a Western district sales office at Los Angeles. James H. Turner is in charge.

Hood Chemical Co., Inc., Pittsburgh, has elected Leonard S. Mudge president.

Koppers Co., Inc., Pittsburgh, has made Charles F. Hosford, Jr., formerly president of Pennsylvania Coal Products Co., a vice president.

C. H. Wheeler Mfg. Co., Philadelphia, has announced the purchase of the marine division of the Wm. Sellers & Co., Inc., Philadelphia.

E. I. du Pont de Nemours and Co., Wilmington, Del., has designated district offices to market tetraethyl lead beginning Jan. 1, 1948. They are: Tulsa, Charles Wirth III, manager; Houston, Joseph A. Hyland, manager; Los Angeles, David H. Conklin, manager; Chicago, Earl G. Bennett, manager; and Wilmington, Norman Kent, manager.

Globe Steel Tubes Co., Milwaukee, Wis., has appointed John F. Scott chemical and metallurgical sales representative in the New York office.

Susquehanna Mills, Inc., New York, has moved to its own building at 404 Fourth Ave.

Allegheny Ludlum Steel Corp., Pittsburgh, has elected E. B. Cleborne executive vice president.

Laclede-Christy Clay Products Co., St. Louis, Mo., has purchased all capital stock of the Osceola Silica & Firebrick Co., Osceola Mills, Pa., Albert B. Agnew has been appointed general manager.

General Mills, Inc., Minneapolis, Minn., has named Almon G. Hovey technical sales service head for the chemical division.

Solvay Sales Corp., New York, has moved the New Orleans branch to 1107 Pere Marquette Bldg., Baronne St. and the Houston office to 1313 City National Bank Bldg., 921 Main St.

Pittsburgh Plate Glass Co., Pittsburgh, has appointed Robert M. Simpson acting district manager for the Chicago territory.

Hercules Powder Co., Wilmington, Del., has established a Naval Stores sales office in the Fisher Bldg., Detroit with R. S. Glover, Jr., manager. Lewis E. Anderson succeeds him as manager of the naval stores branch office in San Francisco.

Whiting Corp., Harvey, Ill., has elected George P. Fisher and A. J. Grindle vice presidents.

Pangborn Corp., Hagerstown, Md., has transferred R. M. Trent to the Pacific Coast as manager of all the business there. J. D. Wise succeeds him as manager of the Pittsburgh district. Frank Newell has been transferred to the Chicago office as district sales engineer.

United States Steel Corp., Chicago, Ill., has announced Ralph T. Seward will be chairman of the U. S. Steel board of conciliation and arbitration on October 1.

Westvaco Chlorine Products Corp., New York, has appointed W. Cameron Caswell manager of the sales service division. Arthur F. Smith has rejoined the New York sales staff as divisional sales manager.

United States Rubber Co., New York, has appointed Robert D. Stuart sales promotion manager of the General Products division.

Pressed Steel Tank Co., Milwaukee, Wis., has added Glyn Thomas to the sales department.

Bjorksten Research Laboratories, Chicago, has leased space from the Edwal Laboratories, Inc. The Edwal Laboratories have transferred a portion of their activities to their Ringwood, Ill., plant.

Tennessee Copper Co., Copperhill, Tenn., has purchased a government owned sulphuric acid concentrator unit for scrap from the East Tennessee Ordnance Works.

Fairfield Laboratories, Inc., Plainfield, N. J., has purchased the Rhodes

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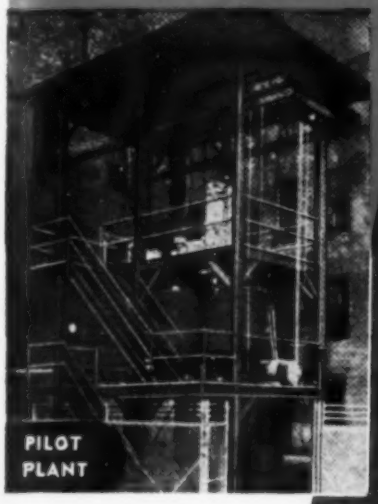

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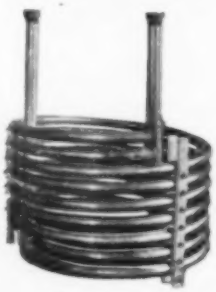

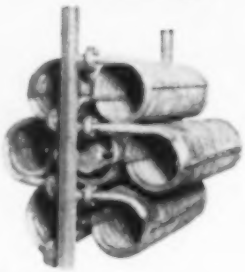

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Heaters • Piping • Pressure Vessels • Receivers • Reboilers

Chemical Corp., Philadelphia. William J. Shibe, chief chemist, is in charge of the Philadelphia plant.

Lester Kehoe Machinery Corp., New York, has moved its warehouse and shop from 15 William St. to 720 Richmond Terrace, Staten Island. The main office remains at 1 East 42nd St.

Blaw-Knox Co., Pittsburgh, has moved its chemical plants division from its war-time headquarters at 5001 Baum Blvd. to 321 Penn Ave.

Electric Machinery Mfg. Co., Minneapolis, Minn., has established a new sales office in Dallas, Texas. H. L. Renking will be in charge.

Pittsburgh Plate Glass Co., Pittsburgh, Pa., has appointed E. Wayne Haley director of sales for the Southern Alkali Corp. His headquarters will be at 30 Rockefeller Plaza, New York City.

W. L. Maxson Corp., New York, has elected Hugo A. Leander president.

Merritt-Monsanto Corp., Lockport, N. Y., is the new name of the Merritt Engineering and Sales Co., Inc. It recently became part of the Monsanto Chemical Co. organization.

Freeport Sulphur Co., New York, has appointed Albert H. O'Neil assistant sales manager.

Sharples Chemicals Inc., Philadelphia, has added Mason Fernald to its development staff.

Hammond Bag and Paper Co., Wellsburg, W. Va., has leased a plant at Pine Bluff, Ark., Allen E. Weaver will be production manager.

Chain Belt Co., Milwaukee, Wis., has appointed Charles Stanton district field engineer in the Philadelphia office.

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has elected Harold S. Falk, president of the Falk Corp., to the board of directors of Allis-Chalmers.

Attapulgus Clay Co., Camden, N. J., has recently moved its Research Laboratory to Camden.

General Detroit Corp., Detroit, has changed the name of its line of fire extinguishers to Quick Aid Fire Guard.

American Cyanamid Co., Bound Brook, N. J., Calco Chemical division has appointed the following regional sales managers. Elmer Carling, 48 West 38th St., New York; S. F. Dim-

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Hour after hour, the Crescent PALLETIER lifts, totes, tiers, climbs ramps, speeds loading and unloading ... shrinks handling time and costs.

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- **Battery Power** eliminates fumes and fire hazard.
- **Full Accessibility** to all mechanisms for easy inspection and maintenance.
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lich, 4500 Euclid Ave., Cleveland; K. A. Coate, Chicago; and L. C. Green, San Francisco.

Owens-Illinois Glass Co., Toledo, has promoted Frank T. Nesbitt to the position of general manager of the Libbey Glass division.

Dodge Mfg. Corp., Mishawaka, Ind., held open house at its plant on August 4-6.

Michigan Chemical Corp., St. Louis, Mich., has elected C. S. Mott and Charles Wetherald to the board of directors.

Oliver United Filters Inc., Hazleton, Pa., is expanding its production capacity of pumps and filters. The new facilities will be completed in the fall.

Air Reduction Sales Co., New York, has opened a new acetylene plant in Dayton, Ohio. R. K. Haygood is plant superintendent.

Girdler Corp., Thermex division, Louisville, Ky., has established a southwestern district office at 5614 Telephone Road, Houston.

Charles H. Welling & Co., Inc., New York, has added George H. Woodard to its staff as a new products engineer.

Godfry L. Cabot, Inc., has appointed B. E. Doughtery Co., Los Angeles, its Pacific Coast agent for General Atlas Carbon Co., a subsidiary.

Alan Porter Lee, Inc., New York, has moved its executive and engineering offices to 150 Broadway.

International Paper Co., International Paper Products division, New York, has opened a branch sales office at 607 South Hill St., Los Angeles.

Ilg Electric Ventilating Co., Chicago, has named Raymond V. Plautsch chief engineer.

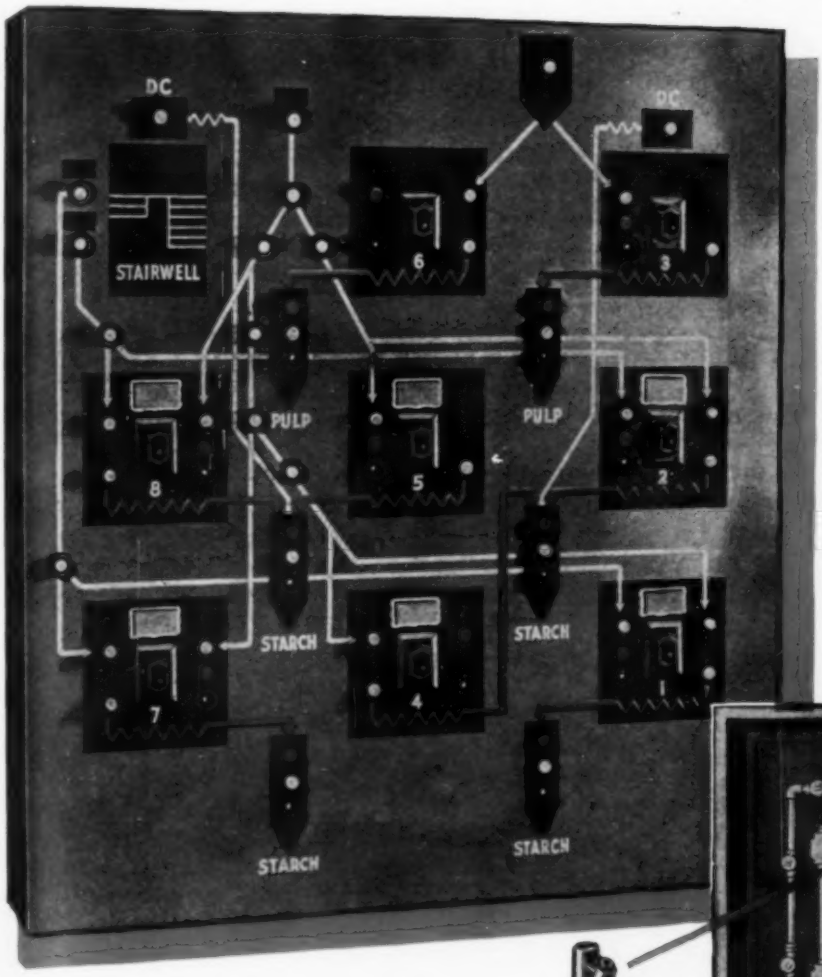
Chas. Pfizer & Co., Inc., Brooklyn, N. Y., is negotiating for the purchase of Citro Chemical Co. of America, Maywood, N. J., a wholly owned subsidiary of the Emerson Drug Co.

Electric Equipment Co., Rochester, N. Y., has opened a New York office at 224 East 38th St.

Michigan Chemical Co., St. Louis, Mich., has recently doubled the capacity of chlorobenzene and DDT production at the Michemco, Pine Bluff, Ark., plant. Further additions are planned for both the Pine Bluff and St. Louis plants.

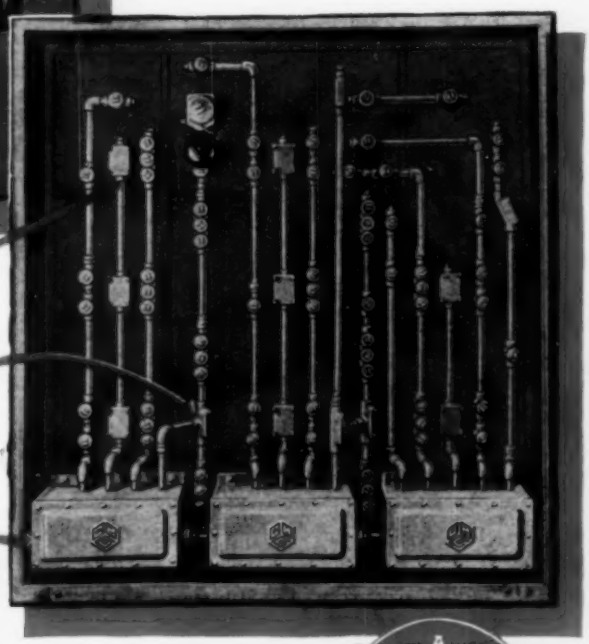
Central flow-line boards for the control of modern industrial processes

are easy to design with CROUSE-HINDS complete line of panel mounting CONDULET equipment for hazardous locations



Crouse-Hinds panel mounting pilot lights and switches provide visual indication of process stages and instant control of processing or manufacturing equipment. The illustrations show front and back views of a flow-line control board in a starch plant where combustible dust creates a Class II (National Electrical Code) hazardous location.

* *CONDULETS are made only by CROUSE-HINDS*



The pilot lights and switches are dust-tight and explosion-proof and are designed for both Class I and Class II hazardous locations. A similar control board for use where flammable gases or vapors create a Class I hazardous location would only require substitution of explosion-proof junction Condulets and the addition of explosion-proof sealing Condulets, as indicated.

Write for additional information.

Type EYS Explosion-Proof Sealing Condulet

Type GUAT Explosion-Proof Junction Condulet

Type EJB Explosion-Proof Junction Condulet

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CONVENTION PAPER ABSTRACTS

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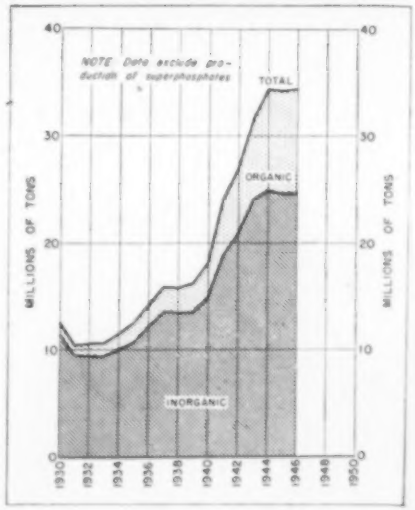
Seventy-Five Years of Chemical Progress

The purpose of the Manufacturing Chemists Association, when founded in May, 1872, although partly social, was also concerned with tariff matters, then as now, a problem of great importance to the industry. Important contributions of the association include transportation and packaging research, the establishment of safety standards, the development of labels for hazardous products, and the presentation of comprehensive statistical data relating to chemicals and chemical production.

World War I made us realize that research required organization and resources never before available. It suggested new fields of research—research in the development of new chemical products and new uses for old products. A new era in education followed, much of it fostered by the chemical industry. Instead of 54 doctor's degrees in 1919, there were 672 conferred in 1941. Instead of the 300 industrial laboratories in 1920, there are over 2,400 today, a substantial percentage of which are chemical.

It is interesting to note how synthetic chemical prices defy the classic law of supply and demand, predicated on the existence of limited supplies of raw materials. The chemical industry has been able to upset this concept by adapting other raw materials to fill existing needs. As a result, the greater the demand for synthetic chemicals, the lower their price.

Although most chemicals are measured in pounds, rather than in tons, the tonnage of chemicals produced in the United States exceeds that of most of the so-called tonnage industries. The accompanying chart shows the growth in tonnage of industrial chemicals produced since 1930, broken down according to inorganic and organic chemicals. In 1946, total production was in



Volume of U. S. Chemical Production, Inorganic and Organic

the neighborhood of 35 million tons, of which about 25 million tons were inorganic, and 10 million tons, organic. While the production of inorganic chemicals was more than double that of ten years ago, the most spectacular growth has been in the production of synthetic organic chemicals.

Today, with entirely new branches of chemical manufacture being opened by such developments as those in organic compounds of silicon and fluorine, the production of a wide variety of organic chemicals from natural gas and the diversification in types of synthetic resins, the chemical industry is the symbol of an expanding economy.

Charles S. Munson, Air Reduction Co., before the 75th Annual Meeting, Manufacturing Chemicals Association, Skytop, Pa., June 4, 1947.

Nitrogen Fixation by "Crossed Discharge"

The Birkland and Eyde electric arc process for the fixation of atmospheric nitrogen yielded an effluent gas containing from 1.0 to 1.5 percent of nitric oxide and a yield equal to about 61 to 63 grams of nitric acid per kwh. It is understood that a certain modification of the Birkland and Eyde process has been made to yield as high as 80 g. of nitric acid per kwh.

The process to be described can be made to yield an effluent gas containing as high as 25 to 30 percent of nitrogen oxides and the yield in terms of grams of nitric acid per kwh. equal to 10 to 15 times, and in some instances as high as 20 times, that of the Birkland and Eyde process.

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The Petroleum Mechanical Engineering Conference at Houston, October 6, 7, 8 will discuss latest Mechanical Engineering developments in Production, Transportation, Refining and Supplying the Petroleum Industry. For veteran A.S.M.E. members, a must. For your younger associates, an opportunity to catch up rapidly on losses due to war-time blackouts of technical conferences. A.I.M E. and A.P.I. cordially invited.

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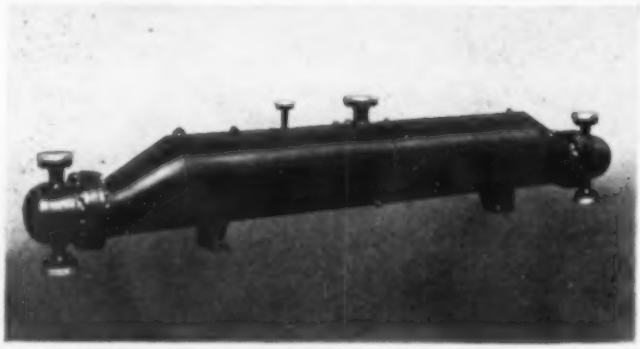
of HEAT EXCHANGERS



This Reboiler generates process steam by passing molten salt, at approximately 750° F. through the tubes, boiling the water in the shell. Tubes are Carbon Moly . . . other construction, Carbon Steel.

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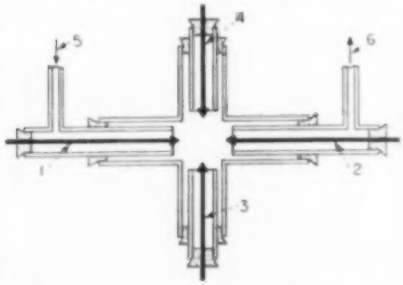
monia oxidation process for nitric acid, the new process shows an appreciably lower capital cost and also an appreciably lower operating and manufacturing cost. The process has been thoroughly demonstrated on a laboratory scale and is in course of being demonstrated on a sizable pilot plant scale.

There has been developed in the laboratory what is called the crosssed discharge, a method based upon a properly controlled high frequency luminous discharge. The accompanying figure shows a diagrammatic crosssection of the discharge reactor in which the two horizontal electrodes 1 and 2 are connected to a high voltage 60-cycle supply, while electrode 3 is connected to a source of high frequency energy and its cooperating electrode, 4, is connected to ground. In



other words, there are simultaneously crossed from separately spaced pairs of electrodes, a high frequency discharge and a low frequency discharge. The air to be reacted enters the equipment at the inlet 5 and after passing through the crossed discharge leaves the discharge reactor through the exit 6, and when so leaving will contain almost any percentage of nitrogen oxides desired short of the theoretical maximum of 40 percent. The higher concentrations are not necessarily the most economical concentrations.

Crossed discharges possess very definite advantages over the use of either component alone as regards yield of nitrogen oxides formed per kva.-hr. or per kwh. In fact the increase, even assuming kwh. equal to kva.-hr., is as much as 300 percent. It should be noted that the selection of 2.48 megacycle for this work was deliberate and calculated, for it is what is defined as a "base line frequency," i.e., a frequency which is not included in either a critical reaction frequency band or a critical electrode frequency band.

The crossed discharge is a distinct and new type of discharge; as distinct from such discharges as the silent discharge, spark discharge, corona discharge or glow discharge as these are distinct from one another. The characteristic and distinguishing features of the new type of discharge are as follows:

1. There is a glow to this discharge

Moving forward with America's leaders
in a mighty era of construction
to build a greater America . . .

KIMBERLY-CLARK INSTALLATION PLACED IN McGRAW HANDS

HARTFORD, CONN.—The Kimberly-Clark Corporation has awarded a contract to F. H. McGraw & Company, engineers and constructors of this city, for machinery installation at Memphis, Tenn. According to F. H. McGraw & Company, the Kimberly-Clark Corporation has in the past performed such mechanical installation with its own forces. This contract calls for the installation of two crepe wadding machines and auxiliaries, plus all necessary electrical, piping, sheet metal and insulation work.

Reprinted with permission from "Paper Trade Journal," June 19, 1947

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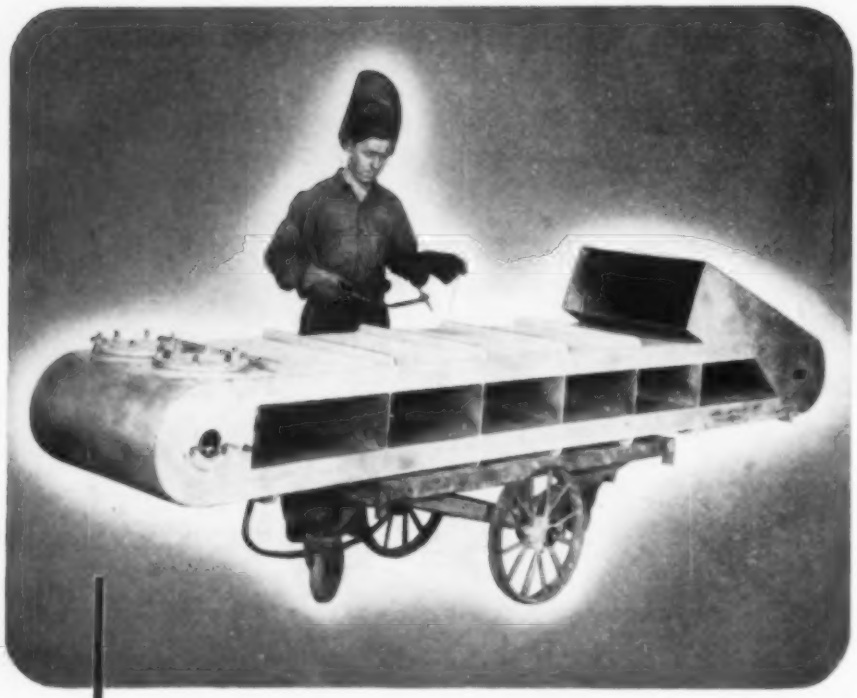

Taking the Bite out of Sulphuric Acid

. . . with acid- and corrosion-resistant Ampco Metal assemblies, fabricated with Ampco-Trode 10 aluminum bronze electrodes

Ampco Metal *gives you these advantages!*

1. Exceptional resistance to corrosion, erosion, abrasion, and cavitation — in the routing of liquids, semi-fluids, and liquids containing solids in suspension, such as: acids, petroleum sludge, alkaline solutions, sea water, mine waters, food-product liquors, etc.

2. Desirable service characteristics — favorable bearing properties . . . high strength . . . ability to resist squashing, bell-mouthing, wear, impact, fatigue.

Again Ampco Metal, the engineered aluminum bronze "without an equal," solves a tough problem—this time for a manufacturer of synthetic alcohol. This alcohol is made from corn cobs and other waste farm products that run through a bath of sulphuric acid. When removed from the bath, the products are thoroughly acid-soaked.

The conveyor used in the removal process is made of Ampco chain; the conveyor housing, shown here, from Grade 8 Ampco Metal in rolled sheet form; and the angles from extruded Ampco Metal. All fabrication was done with Ampco-Trode 10 electrodes, which have the same acid- and corrosion-resistant properties as the parent metal.

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P-22

that has definite boundaries to its luminous volume. 2. It is a relatively cold discharge. 3. This type of discharge shows a low energy density, that is, total watts supplied to the discharge divided by the volume in cc. of the luminous discharge. 4. Crossed discharges result in unexpected high activation of gases and relatively high yields of reaction products.

The mechanism that results in the characteristics of the crossed discharge is not well understood. Further, it has been observed that, as the difference in frequency of the two component discharges increase, the benefits and characteristics, as a rule, become more pronounced. However, there are very definite exceptions to this generalization.

The production of crossed discharges requires some little experience. It is necessary to adjust the crossed discharge to what is called "minimum sustaining energy." By this is meant the minimum of energy that will sustain the discharge without "fluttering." By fluttering is meant an electric fluttering which manifests itself in a periodic distortion of the wave front, not the visible fluttering of the discharges. Yields fall away if the energy supplied here exceeds or is less than the critical minimum sustaining energy value.

For years, research workers have intuitively sensed the possibility of catalyzing chemical reactions in an electric field of certain critical frequencies. The work under discussion shows the existence of critical frequencies and that, as a result of applying such critical frequencies, not only is the speed of the reaction greatly increased but the chemical and the energy yields are also greatly increased.

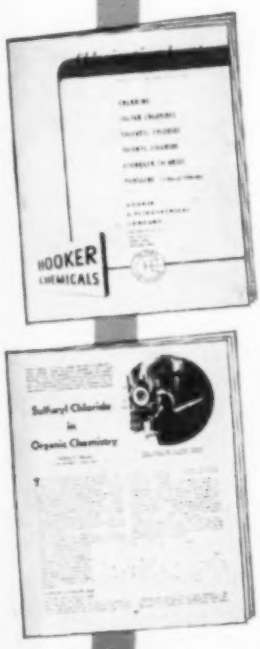
By critical electrode frequencies, are meant those frequencies that catalyze the given reaction and which appear to be dependent solely upon the nature of the electrode material and independent of the reaction. About fifty critical frequencies have been located within the range of about 18 to 620 meters, using various electrode materials and, in all cases, applied to the oxidation of nitrogen. Some of these critical wave lengths, six to be specific, could be separated from the rest and called critical reaction frequencies inasmuch as they appeared to be concerned solely with the nature of the chemical reaction in progress and to be quite independent of the nature of the electrode material. The rest of the critical wave lengths found were in some way related to the electrode material.

When two or more methods of activation (i.e. crossed discharge, critical reaction frequencies, and critical electrode frequencies) can be simultaneously applied, the benefits that have

5 Types of Reactions

you can carry out with Sulfuryl Chloride

1. **Chlorination of aromatic compounds**
2. **Chlorination of aliphatic compounds**
3. **Sulfonation of aliphatic compounds**
4. **Sulfonation of aromatic compounds**
5. **Acylation** (preparation of esters, acid chlorides, anhydrides, etc.)



Chlorination

Sulfuryl Chloride offers certain advantages as a chlorinating agent that are quite universally recognized. They are principally:

1. The heat of chlorination is far less than that using elementary chlorine.
2. It is possible by using different catalysts, reacting at different temperatures and by carefully controlling proportions of reactants, to chlorinate selectively.

Sulfonation

The availability of sulfur in the compound makes it equally valuable in the sulfonation of aromatics and aliphatics. Sulfonyl chloride derivatives may be obtained by the addition of small quantities of aluminum chloride to a cooled reaction mixture of sulfuryl chloride and aromatic hydrocarbons.

Formation of alkyl sulfonyl chlorides with yields as high as 70% are reported in the sulfonation of paraffin hydrocarbons in the presence of light and a catalyst.

Acylation

Alkyl chlorsulfonates are the products of reactions of sulfuryl chloride with many alipathic alcohols. A number of interesting acylated products may be produced through the reaction of this versatile chemical with aliphatic and aromatic amines.

* * *

You who are interested in the synthesis of organic chemicals will find Sulfuryl Chloride a valuable reagent. With Hooker Sulfuryl Chloride you will be working with a particularly pure product that tends to increase yield and eliminate side reactions.

For more information on Sulfuryl Chloride as a chlorinating agent write on your letterhead for Bulletin 328A. It also includes data on other Hooker chlorinating agents. For information concerning other reactions of Sulfuryl Chloride send for Bulletin 330, a reprint of an article on "Sulfuryl Chloride in Organic Chemistry." Technical Data Sheet 717 contains typical properties and specifications of Hooker Sulfuryl Chloride.

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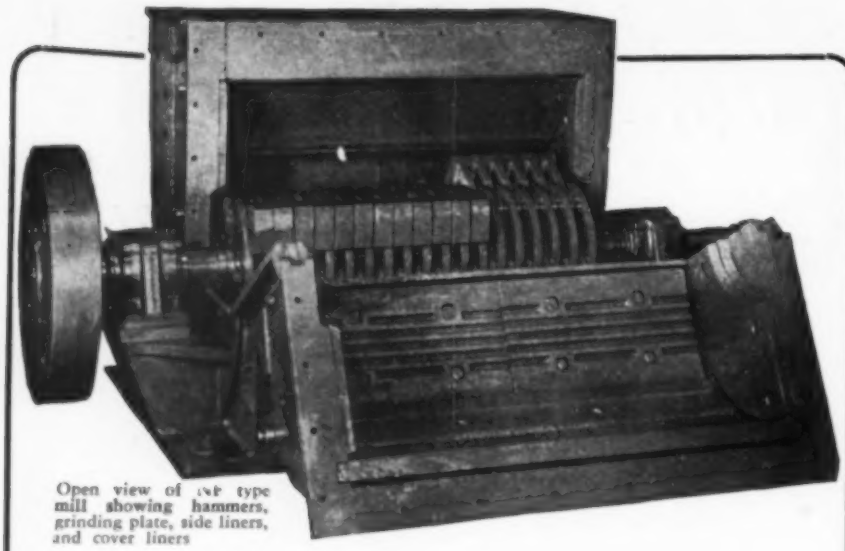

Open view of [illegible] type mill showing hammers, grinding plate, side liners, and cover liners

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been enumerated may be simultaneously achieved and pyramided. The phenomenon involved when doing so is termed "multiple activation."

William J. Cotton, Pennsylvania Coal Products Co., before the Electrochemical Society, Louisville, Ky., April 9, 1947.

Incompatible Plasticizers

Greater facility in the molding of synthetic rubber is promised by a new technique, utilizing unorthodox softening agents. Raw synthetic rubber is elastic and resists efforts to mold it into desirable forms, but it can be made as pliable as putty if it is mixed with a softening agent with which it is incompatible, as water is incompatible with oil. Previous experience has indicated that incompatibility of rubber and softening agent was to be avoided because the softener could be easily squeezed out, but the use of bulky plasticizers has solved this problem. The relatively large particles of the newly adopted softeners cannot slip through the fine mesh of rubber molecules.

Articles made from raw synthetic rubber prepared with the usual compatible plasticizers are semi-liquid and tend to lose their shape while awaiting vulcanization. On the other hand, rubbers prepared with incompatible softeners retain molded shapes indefinitely and therefore require less care in processing. Tests have shown that there is a particular incompatible softener suited to each major type of synthetic rubber.

Isoprene-styrene copolymers and polyisoprene may be especially useful in applications where improved dynamic modulus and low internal friction are predominantly important. For general use, however, these types of synthetic rubber seem to be inferior in low-temperature properties, and resistance to stretching and cut.

A. M. Gessler and A. F. Sayke, Standard Oil Development Company, and J. M. Willis, L. B. Wakefield, R. H. Poirier and E. M. Glymph, Firestone Tire and Rubber Company, before the Division of Rubber Chemistry of the American Chemical Society, Cleveland, Ohio, May 26, 1947.

Engineer Collective Bargaining

A medium for concerted action of engineering societies to attain their objectives exists in the Engineers Joint Council, which consists of representatives of five national engineering societies, including the four "founder" groups. The work of this council in national labor legislation through a labor panel set up by the five member societies and the National Society of Professional Engineers resulted in getting into the legislation its principal objectives: that engineers should have freedom of choice in accepting or rejecting collective bargaining; that they

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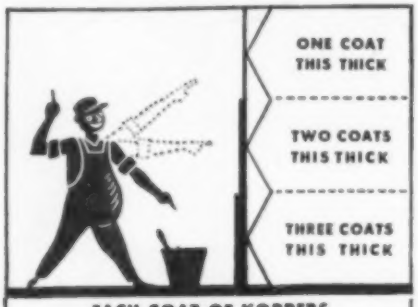

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- ✓ quick drying (usually a matter of minutes)

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AND THE COAT IS THICK... Bituplastic covers heavily; 1/64" to a coat, or about 5 times the thickness of ordinary paint. Successive applications can provide a seamless, non-porous sheath up to 1/16" in thickness, completely resistant to most corrosive conditions.

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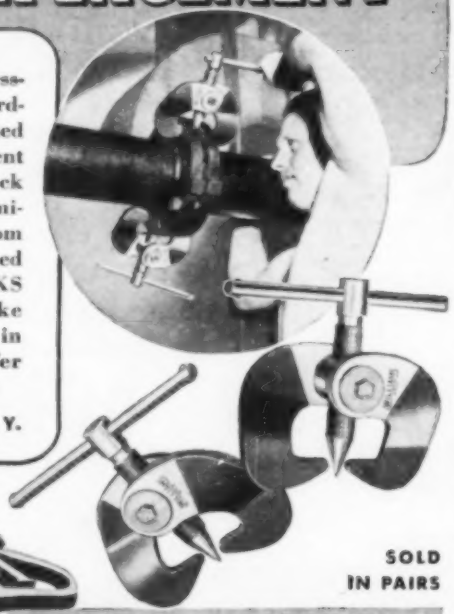

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should not be arbitrarily included with employees of nonprofessional grade, as is true of existing unionization of engineers under the Wagner Act; that if collective bargaining is the proper procedure engineers should have the right to organize their own professional bargaining unit; and that the engineer, being a professional man, should retain the right of individually approaching management in negotiation of employment conditions. From a questionnaire circulated through the ASME it was concluded that 75 percent of the members want complete exclusion from national legislation such as the Wagner Act, but that a substantial minority, made up largely of younger men, prefer to retain the right to bargain collectively, providing it can be done with the proper safeguards, of their own choice and in their own fashion.

Eugene W. O'Brien, W. R. C. Smith Publishing Co., before semi-annual meeting, the American Society of Mechanical Engineers, Chicago, Ill., June 16, 1947.

New Painkillers

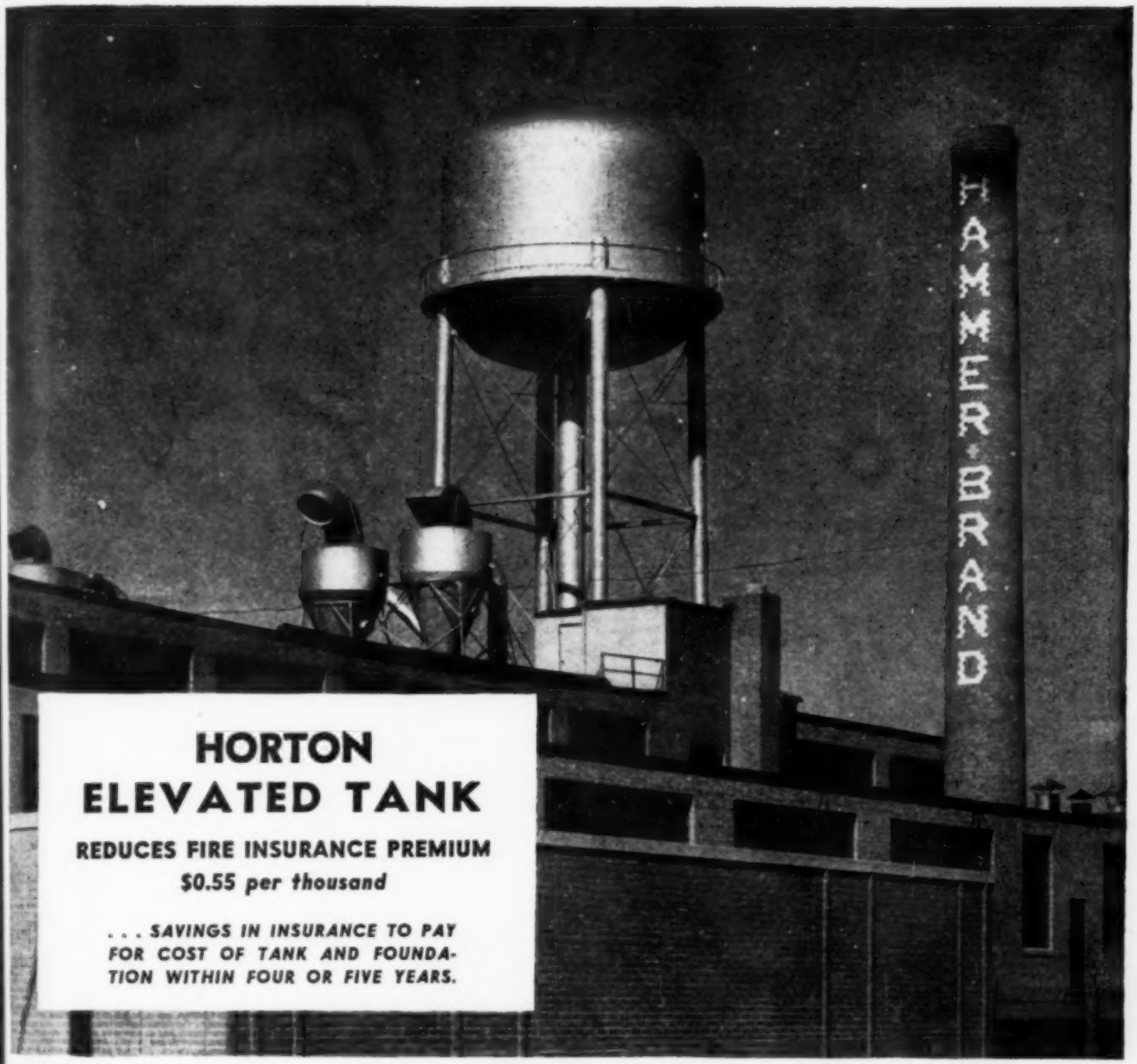
Medical science may find powerful new allies in a class of hitherto ignored chemicals, which are proving effective as anesthetics and germicides. Two chemical keys are responsible for the activity of the recently investigated compounds, an amino group consisting of nitrogen and hydrogen and a mercapto group consisting of sulphur and hydrogen. These groups have potent effects on many enzymes, the agents that police biochemical activity within living organisms. Similar compounds, containing alcohol groups instead of sulphur have been extensively employed in the chemical industry for the manufacture of medicines. During recent investigations, new methods for preparing compounds containing sulphur and amino groups have been developed and these techniques will be of interest to scientists who wish to expand the work.

Chester M. Suter, Sterling-Winthrop Research Institute, before National Organic Chemistry Symposium, American Chemical Society, Boston, Mass., June 12, 1947.

Physical Chemistry of Polymers

THE mechanical, thermodynamic, optical and electrical properties of linear polymers are characteristic for these substances, and may be correlated with the fact that many units are coupled together by primary valence bonds to form long flexible chains.

In stretching a rubber band, work is not done against internal lattice forces as in the case of crystalline compounds, but the various chains are moved into less probable, more highly



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REDUCES FIRE INSURANCE PREMIUM

$0.55 per thousand

. . . SAVINGS IN INSURANCE TO PAY FOR COST OF TANK AND FOUNDATION WITHIN FOUR OR FIVE YEARS.

The 100,000-gal. Horton elevated tank shown above was recently erected for the Herman Basch & Co., Inc., fur dressers and dyers of North Bergen, N. J., to provide gravity water pressure for their automatic sprinkler system. The installation of this tank has resulted in a reduction of $0.55 per thousand in the company's fire insurance premium, an estimated savings sufficient to pay for the tank within five years!

The sprinkler system is connected to two municipal water mains, one on the east side and one on the west side of the factory block, by an interconnecting 8-in. line which feeds the individual systems in the different buildings. The new tank serves as a secondary source of supply in the event the municipal water supply should prove insufficient. It is connected to the 8-inch line through a check valve.

Horton elevated tanks are widely used to provide gravity water for automatic sprinkler systems. Not only can they be depended upon to supply water to sprinkler heads the moment a blaze breaks out but also they can substantially lower a company's fire insurance premiums. If your plant is protected by an automatic sprinkler system, why not get an estimate on a Horton elevated tank to "back it up". Perhaps elevated storage can also reduce your insurance premiums. Write our nearest office today for details.

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extended configurations. When the external force is released, the individual molecules diffuse back, under normal thermal motion, to their preferred configurations.

Thus the mechanical properties of rubber-like molecules are due to internal processes involving a change of entropy rather than a change of energy.

Molecules of organic chemicals derived from ethylene are especially apt to join endwise to form polymers with the chain-like structure.

Polymers composed of long chains may be represented by the formula of a simple chemical group repeated n times. They may be thought of as mixtures of many similar substances, alike in those properties caused by the repetition of the simple group but differing because the number n by which it is multiplied may have many different values throughout the mass of the material.

In other words, chemically similar substances with a distribution of molecular weights are formed.

Aside from their size, linear polymer chain molecules differ strikingly from ordinary organic molecules in another significant way. In general, they are highly elastic, a property inherent in the chain structure and one of the outstanding characteristics of polymers.

The first indisputable evidence concerning the molecular weights of polymers was obtained by means of the ultracentrifuge. Experiments on dilute polymer solutions gave values ranging from tens of thousands to the order of a million for the molecular weights of polymers obtained by chain reaction.

Another absolute method of determining molecular weights of polymers is the classical method of osmometry. Theoretical studies of the thermodynamics of polymer solutions lead unambiguously to the conclusion that the entropy of polymer solutes can not be expressed by the formulas of classical thermodynamics but rather that explicit inclusion of the polymer configurations in the calculation of entropy is necessary. The result is that the volume fraction of solute rather than the mol fraction appears as the significant independent variable, which means a change of orders of magnitude in scale.

Recently Debye has shown a relationship between the osmotic pressure and the intensity of light scattered from a solution of macromolecules, that is, very large molecules. This gives another powerful tool for use in the study of polymers. By studying the intensity of the scattered light as

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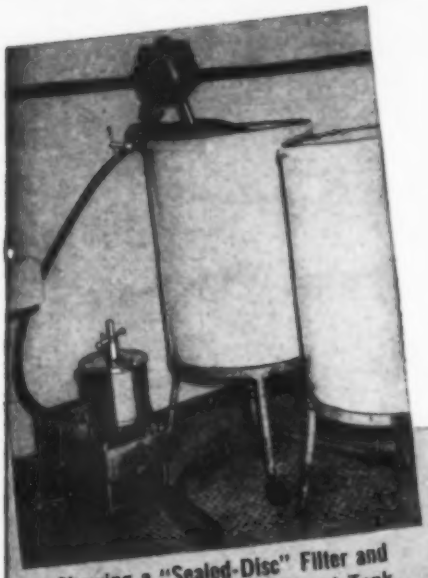

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a function of angle, and the depolarization of the scattered light, it is possible to obtain information on the geometry of polymer molecules and the distribution of molecular weights. Viscosity measurements are generally useful as rapid and convenient means of comparing different polymers and have been used technically for this purpose for some time although it is only recently that a quantitative explanation of the phenomena has been attempted. Many vinyl polymers are hydrocarbons: poly-styrene, poly-isobutylene and polythene are familiar examples. Electrically, these are quite simple in their behavior. Their power absorption is practically zero, and aside from a simple density change, the dielectric constant is independent of temperature. If the X in polyvinyl-X is a polar group, however, such as halogen, ester or alcohol, then the electrical properties become sensitive to temperature and frequency.

Raymond M. Fuoss, Yale University, for Sigma Xi National Lectureship, The Society of Sigma Xi, 1947.

600 Percent Increase In Heavy Carbon

The newly developed "chemical exchange" separation method has made it possible to prepare carbon-13 compounds at seven times the previous rate. Chemical exchange utilizes a tall glass tower, somewhat like those that are used to distill gasoline from petroleum, and two compounds of the element to be separated, one of them a liquid, the other a gas. When the liquid trickles down from to top of the tower, the gas rises from the bottom and the heavier atoms become associated with the liquid, while the lighter ones migrate to the gas. For the separation of carbon, hydrocyanic acid gas and a solution of sodium cyanide have been used, and another system involving carbon dioxide gas and bicarbonate of soda solution has also proven satisfactory. At the completion of the process, half of the carbon atoms in the liquid are heavy carbon. The same technique has been used to obtain heavy atoms of sulphur, nitrogen, and hydrogen. All of which are proving highly useful in the study of industrial processes as well as biological problems.

David W. Stewart, Eastman Kodak Co., before the Rochester Section, the American Chemical Society, Rochester, N. Y., May 19, 1947.

New Laboratory Construction Plans of Schools

NEW chemical laboratories costing approximately $100,000.000 will be added to the facilities of United States

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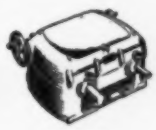

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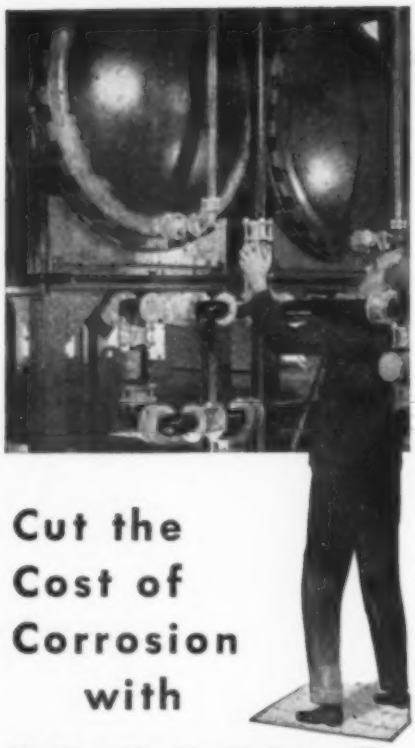

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colleges and universities during the next few years.

"Laboratories for instructional purposes had of necessity to be by-passed during the war," Dr. Lewis said. "As a result of this, and intensified by the very large postwar enrollments of G.I.'s with enhanced interest in scientific courses, there is now underway an enormous college and university chemical laboratory building program. The amount of actual construction during the next five years as stimulated by these need factors will be affected by economic conditions, availability of materials, and by other factors.

"Estimates of new construction based upon the results of a questionnaire are to be considered as conservative, since the questionnaire was limited to just one-half of the colleges and universities listed in the educational directory for 1946-47 of the Federal Security Agency, Office of Education."

Of 350 institutions questioned, 137 indicated projected laboratory construction, many expecting to complete their operations by 1949.

Fifty-eight institutions are planning new chemistry laboratories and twenty-eight new general science buildings, twenty-six are extending current buildings, and twenty-five are rebuilding and modernizing their present buildings, the survey showed. Sixteen other schools are planning new buildings but are not far enough along with their plans to estimate space or costs.

Harry F. Lewis, Institute of Paper Chemistry, before the Division of Chemical Education, American Chemical Society, Atlantic City, April 17, 1947.

FOREIGN LITERATURE ABSTRACTS

Lead Carbonate From Lead Slime

WHITE lead is used as a desulphurizer in the preparation of certain organic reagents which are used in rubber manufacture. All the lead carbonate is converted to lead sulphide and is removed in the form of a slime which contains lead sulphide, a great deal of water, alcohol and some other organic compounds. At present this slime is used for the production of metallic lead so that all the lead carbonate used is converted to a comparatively low-value product. It would therefore be more profitable to find a method for recovering the lead slime in the form of lead carbonate which is more expensive and less readily available than metallic lead. Oxidation roasting of lead slime at 400-500 deg. completely eliminates impurities of an organic nature. Due to sintering, however, the sulphide sulphur cannot be completely converted to the sulphate. The largest amount of sulphate sulphur obtained experimentally was 68 percent of the total quantity of sulphur. Sulphating of the slime at 350-380 deg. with strong or diluted (1:1 and 1:2) sulphuric acid converts all the lead to the sulphate form, but preserves the carbon of all the organic portion in the treated material. The combination of roasting and sulphating, with subsequent conversion of the lead sulphate to carbonate by means of strong solutions of soda, can be recommended as the first method for recovery of lead slime. Of the three methods of chlorination of the lead slime, the simplest method in regard to process, apparatus and control, as well as the most economical one for chlorine consumption, was the method of chlorination of the lead slime solution in fused lead chloride. An increase in the temperature of chlorination leads to an increase in loss by volatilization. The temperature of the process should not exceed 460 deg. The fusion of lead slime, therefore, should be carried out in such quantities that the content of PbS in the fusion does not exceed the entectic (20 percent PbS and 80 percent $PbCl_2$), and sodium chloride should be introduced periodically in order to lower the melting point of the $PbCl_2$. As a second, more profitable method for recovery of lead slime, we recommend the method of chlorination of lead slime by the described method with subsequent conversion of the $PbCl_2$ to $PbCO_3$ by wet grinding in a ball mill.

Digest from "Development of a Method for Conversion of Lead Slime from Diphenylguanidine Manufacture to Lead Carbonate" by N. N. Murach, V. I. Kolosov and E. V. Kiseleva, *Zhurnal Prikladnoi Khimii* XX, 1-2, 132-143, 1947. (Published in Russia).

Allicine As Antibiotic

ALLICINE is an antibacterial substance isolated by Cavallito, Bailey, Buck and Suter from garlic. The medicinal qualities of garlic have long been known in popular medicine and efforts have been made to isolate the active principle of this plant since 1928-1930. Allicine was isolated in the pure form as follows: ground cloves of garlic were extracted with alcohol. The aqueous residue left after evaporation, containing the active principle, was distilled in a vacuum with steam. The allicine went over with the steam and was then extracted with ether. After evaporation of the ether solu-

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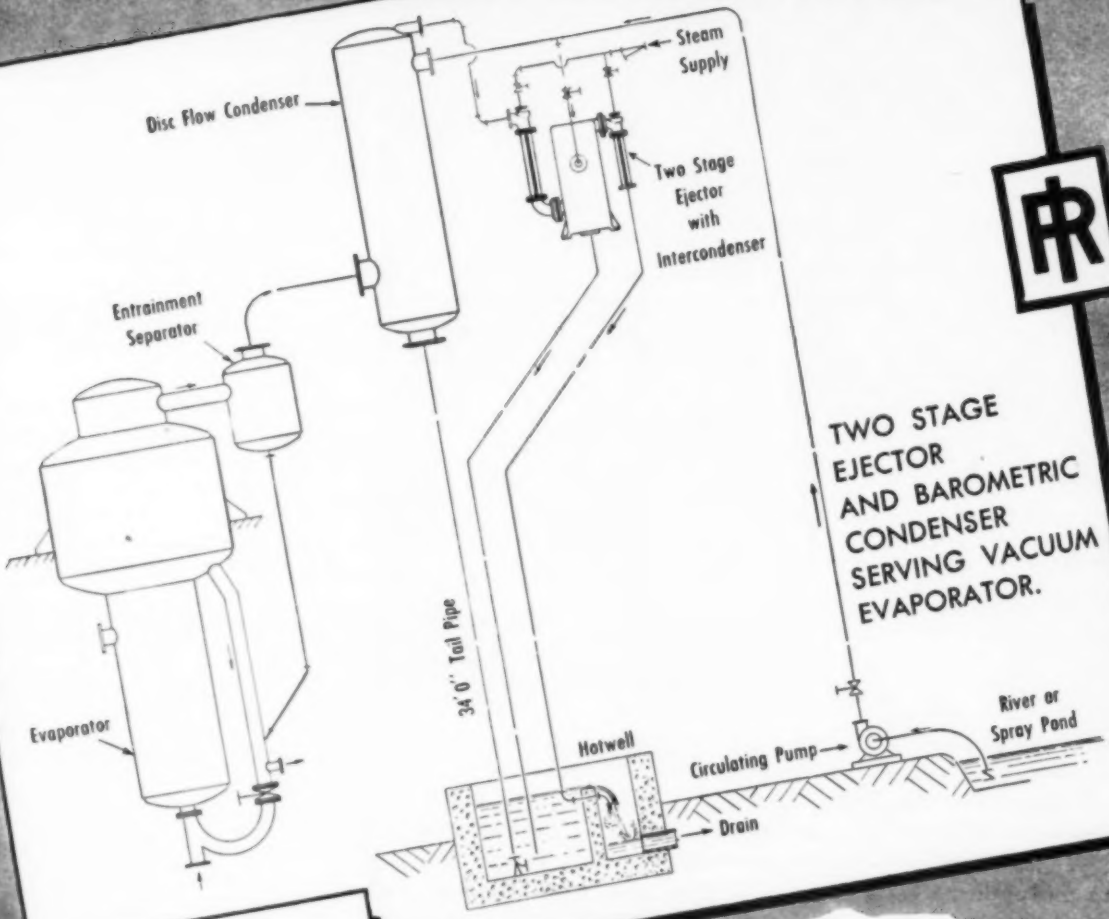

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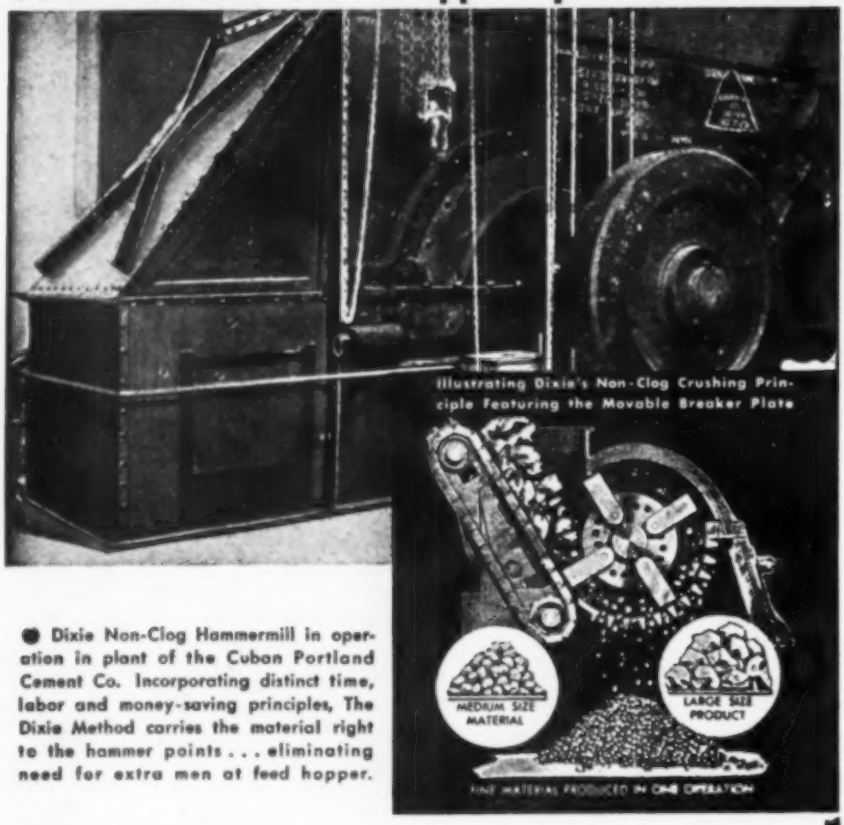
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● Dixie Non-Clog Hammermill in operation in plant of the Cuban Portland Cement Co. Incorporating distinct time, labor and money-saving principles, The Dixie Method carries the material right to the hammer points . . . eliminating need for extra men at feed hopper.

Down in the bay of Mariel, some 20 miles out of Havana City, the semi-tropical climate accounts for 50 to 70 inches of rainfall per year. For the Cuban Portland Cement Co., this factor . . . combined with the soft, wet material generally encountered in quarrying operations . . . was seriously curtailing production.

It was not until the installation of a Dixie Non-Clog Hammermill, equipped with the patented Movable Breaker Plate, that delays due to "Choke-Ups" were reduced and a new 'high' in continuous production was established. Since then, this Dixie Hammermill has worked under the worst possible conditions . . . operating at times for a whole week on raw material which was "nothing but a mass of plastic, sticky, water-sodden mud."

This is only one of the numerous instances where a Dixie Hammermill has been instrumental in keeping production at a *high* peak . . . yet at a *low* cost.

Let an experienced Dixie engineer show you how the Dixie Hammermill can increase production and profits in your crushing operation.

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tion, pure allicine was obtained. Approximately 6 g. of allicine was obtained from 4 kg. of garlic. Allicine is a colorless, oily liquid, slightly soluble in water, but mixing with alcohol, benzene and ether in any proportions. It irritates the skin and has a sharp garlic odor, is unstable and decomposes rapidly on heating, so that it cannot be distilled without decomposition. On standing, either in the pure form or in solutions, allicine gradually loses its activity. Microbiological tests showed allicine to have an activity of approximately 15 Oxford units per milligram. It is therefore approximately 100 times less active than penicillin in regard to Staphylococcus aureus. It has a wider range of action than penicillin, and it is almost equally effective against gram-positive and gram-negative microbes. Allicine, for example, suppresses the growth of cholera vibrio even in very great dilutions, 1:250,000, whereas penicillin does not act under these conditions even in dilutions of 1:5,000. The toxicity of allicine is fairly low, a lethal dose for mice consisting of approximately 60 mg. (in aqueous solution) per kilogram of body weight when taken internally, and 120 mg. when applied subcutaneously.

Digest from "Certain Antibiotics" by I. J. Postovskii and N. P. Bednyagin. *Uspekhi Khimii* XVI, No. 1, 3-28, 1947 (Published in Russia).

Carbon Dioxide Absorption With Ethanol Amines

APPLICATION of organic absorbents, especially ethanol amines, for purification of industrial gases from carbon dioxide and hydrogen sulphide has become very widespread in the last five to eight years. It is a more economical method for removing these impurities from gases than such methods as washing with water under pressure, or using caustic alkali, sodium or potassium carbonate. The authors conducted investigations on the absorption of carbon dioxide, hydrogen sulphide and their mixtures with solutions of mono-, di- and triethanol amine, as well as with mixtures of ethanol amines, to supplement available data on this subject and to determine the absorption process and to select the right absorbent for different conditions. Absorption of carbon dioxide with aqueous solutions of ethanol amines belongs to the type of processes in which absorption is accompanied by a rapid chemical reaction in the liquid phase. Bicarbonates as well as carbonates are formed. Both CO_2 and H_2S are absorbed by solutions of ethanol amines at a temperature of approximately 40

In Any V-Belt Only the SIDES Touch the Pulley

The Sides Do ALL the GRIPPING

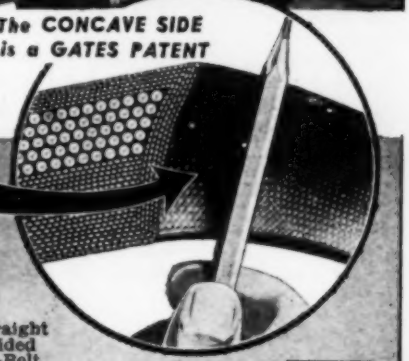
Diagram of V-Belt in Sheave Groove

— Naturally, It's the SIDES that GET the WEAR!

The moment you look at a V-belt in its sheave, you see that the *sides* do all the *gripping*—They get *all the wear* against the sheave groove wall. The sides *pick up* the load. They transmit that load to the belt as a whole. And then, once more, the sides—and the sides alone—take hold of the driven pulley and deliver the power to it.

This simple fact explains why you have always noticed that the *sidewall* of the *ordinary* V-Belt is the part that *wears out first.*

★Now See How the *Patented* CONCAVE SIDE *REDUCES Sidewall Wear - Lengthens Belt Life!*



The CONCAVE SIDE is a GATES PATENT

Clearly, since the sidewall is the part that wears out first, anything that prolongs the life of the sidewall will lengthen the life of the belt. The simple diagrams on the right show exactly why the ordinary, straight-sided V-Belt gets excessive wear along the *middle* of the sides. They show also why the Patented Concave Side greatly reduces sidewall wear in Gates Vulco Ropes. That is the simple reason why your Gates Vulco Ropes are giving you so much longer service than any straight-sided V-Belts can possibly give.

Straight Sided V-Belt

Fig. 1

How Straight Sided V-Belt Bulges When Bending Around Its Pulley

Fig. 1-A

You can actually feel the bulging of a straight-sided V-Belt by holding the sides between your finger and thumb and then bending the belt. Naturally, this bulging produces excessive wear along the middle of the sidewall as indicated by arrows.

Fig. 2

Gates V-Belt with Patented Concave Sidewall

Showing How Concave Side of Gates V-Belt Straightens to Make Perfect Fit in Sheave Groove When Belt Is Bending Over Pulley.

Fig. 2-A

No bulging against the sides of the sheave groove means that sidewall wear is evenly distributed over the full width of the sidewall—and that means much longer life for the belt!

★More Important *NOW* That Gates SUPER V-Belts are Available

Now that Gates *Specialized* Research has resulted in Super V-Belts capable of carrying much heavier loads—up to 40% *higher horsepower ratings* in some cases—the sidewall of the belt is called upon to do even *more work* in transmitting these heavier loads to the pulley. Naturally, with heavier loading on the sidewall, the life-prolonging Concave Side is more important NOW than ever before!

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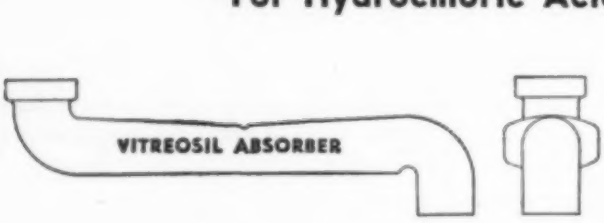

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deg. C. and the spent solutions are recovered by boiling at 103-105 deg. C. to remove the gases absorbed in the absorber. It was found that an increase in the degree of conversion of ethanol amines to carbonates causes a rectilinear decrease in the coefficient of absorption, K_ga. Increase in the CO_2 content of the gas lowers K_ga. An increase in the velocity of the liquid increases K_ga. A change in the velocity of the gas has no substantial effect on the coefficient of absorption. The value of K_ga goes through a maximum with increase in the concentration of ethanol amines. An increase in the temperature of the absorbing solutions from 25 to 50 deg. C. brings about an increase in the coefficient of absorption. Further increase in temperature up to 75 deg. changes K_ga very little. Under the same conditions, K_ga is 2-2.5 times greater for solutions of monoethanol amine than for diethanol amine, and 20-30 times greater than for triethanol amine.

Digest from "Absorption of Carbon Dioxide with Ethanol Amines. I. Rate of Absorption of Carbon Dioxide with Mono-, Di- and Triethanol Amine," by A. L. Schneerson and A. G. Leibusch, *Zhurnal Prikladnoi Khimii* XIX, No. 9, 869-875, 1946. (Published in Russia).

Venezuelan Oil Production

In 1945 Venezuela produced 323,361,000 bbl. of petroleum, which gave her second place as a petroleum-producing nation. In 1946, however, production had increased to approximately 391,482,000 bbl. Approximately 68.9 percent of this quantity is produced by the western oil fields of Venezuela, the Bolivar field producing 58.4 percent of the country's total. The eastern fields of Venezuela produce approximately 31.1 percent of the total, the most productive being the fields of Jusepin-Santa Barbara-Travieso which produces approximately 11.3 percent of the country's total. The Guara area, one of the more recently discovered fields in the eastern section, already produces over 31 million bbl. and soon promises to become the chief producing area of the eastern section of the country. Almost 95 percent of the total production for 1946 can be attributed to the three principal producing companies. Creole Petroleum Corporation, Shell and Mene Grande Oil Co. In the first ten months of 1946, 510 wells were drilled in Venezuela, 304 of them in the east and 206 in the west. Of these, 457 were petroleum wells, 2 of them gas wells and 51 were dry.

Digest from "Venezuela Maintains Second Place Among the Petroleum-Producing Countries," by A. N. Sutton, *Industria Minera* VI, No. 67, 31-35, 1947. (Published in Argentina).

CHEMICAL ENGINEER'S BOOKSHELF

Lester B. Pope, ASSISTANT EDITOR

Words, Words, Words

CONCISE CHEMICAL AND TECHNICAL DICTIONARY. *Edited by H. Bennett. Chemical Publishing Co., Brooklyn, N. Y.* 1120 pages. $10.

Reviewed by James A. Lee

IN THIS dictionary the author has benefitted by experience obtained in earlier volumes of this same nature. A very legible type has been used. He has greatly increased the number of definitions. About 50,000 are included in this volume which covers every field of scientific and technical development. It is said to contain many thousands of chemical, physical, metallurgical, mineralogical, biological, medical, pharmaceutical, mathematical, botanical terms, descriptions of the most important manufacturing processes and equipment, raw materials and finished products, terms used in mechanical, electrical, radio and television engineering, welding and other shop practices.

For chemical compounds, in most cases, the following data are listed: chemical name, synonymous name, semi-structural formula, molecular weight, physical properties, specific gravity, melting point, boiling point, solubilities and uses.

A special feature of this dictionary is a compilation of tradenames or proprietary products. Not only the chemical and physical properties and applications of these tradename products are listed but also their chemical compositions.

Oil Economy

PETROLEUM PRODUCTION. *Volume II, The Optimum Rate of Production. By Park J. Jones. Reinhold Publishing Corp., New York.* 293 pages. $4.50.

Reviewed by Palmer McCurdy

THE author's fundamental precept in attaining an optimum rate of production is based upon selection of the production method. Factors which affect the selection are the number and location of wells, their individual producing rates and gas and water injection. In addition to the possible need for compressor, cycling or water plants. All estimates must be made from the viewpoint of obtaining maximum benefits for the entire reservoir and not for the individual leases, thus avoiding losses resulting from a smaller ultimate recovery, unnecessary investments, higher operating expenses or slower rates of production.

With the above basic premises established, there follows an exhaustive treatment of all phases of the problems of optimum rates and methods of production, including an appropriate discussion of elementary economics. That this book is not for persons with a casual curiosity about the subject is quickly demonstrated by a cursory examination of its twelve chapters, which contain 153 sets of curves and 245 equations. The method of presentation is logical, however, and a reader well grounded in the subject should experience only occasional difficulties in following the reasoning.

It's the Law

THE ENGINEER AT LAW. (2 Vols.) *By C. B. and J. R. McCullough. The Iowa State College Press.* 447 *and* 442 *pages.* $3 *per vol.*

Reviewed by H. A. Toulmin

THIS is a competent contribution to the literature of one profession for the use of another. In the last 25 years a number of books have been written for the purpose of educating the engineer in legal matters. It would be equally helpful if someone would write a book to educate the lawyer in engineering.

The work of Messrs. McCullough covers a wide field of engineering problems, particularly those dealing with general contracting. Much of the material will be of no practical use but only of general educational value. Other portions of the book are inaccurate and are not up-to-date, such as the discussion of trade-marks. But this is to be expected in a book of the general character of this type where it is impossible to have a volume that is up-to-date or is accurate in all details. The very effort to make the book one of general interest necessarily defeats the purpose of having an accurate text.

Engineers who read these books should rely upon them only for general information and not as a basis of specific information upon which they can take action to take care of their own affairs. Nothing would be more dangerous than to rely upon these books for the purpose of any explicit guidance on any practical problem. They are merely educational in tone and content and are not sufficiently accurate or reliable for the purpose of detailed guidance of any of the readers in the engineering profession.

RECENT BOOKS RECEIVED

Adventures in Man's First Plastic. By N. S. Knaggs. Reinhold. 329 pages. $6.75.

Bibliography of Hydrocarbons Under Pressure. By D. L. Katz and M. J. Rzasa. J. W. Edwards. 306 pages. $4.

Encyclopedia of Hydrocarbon Compounds. Vol. II. By J. E. Faraday. Chemical. 603 pages. $17.50.

Manual for Process Engineering Calculations. By Loyal Clarke. McGraw-Hill. 438 pages. $11.

Phenoplasts, Their Structure, Properties and Chemical Technology. By T. S. Carswell. Interscience. 267 pages. $5.50.

Volumetric Analysis. Vol II, 2nd Ed. By I. M. Kolthoff and V. A. Stenger. Interscience. 374 pages. $6.

The Water Soluble Gums. By C. L. Mantell. Reinhold. 279 pages. $6.

Wood Pulp and Allied Products. 2nd Ed. By Julius Grant. Leonard Hill Ltd. 312 pages. 35 s.

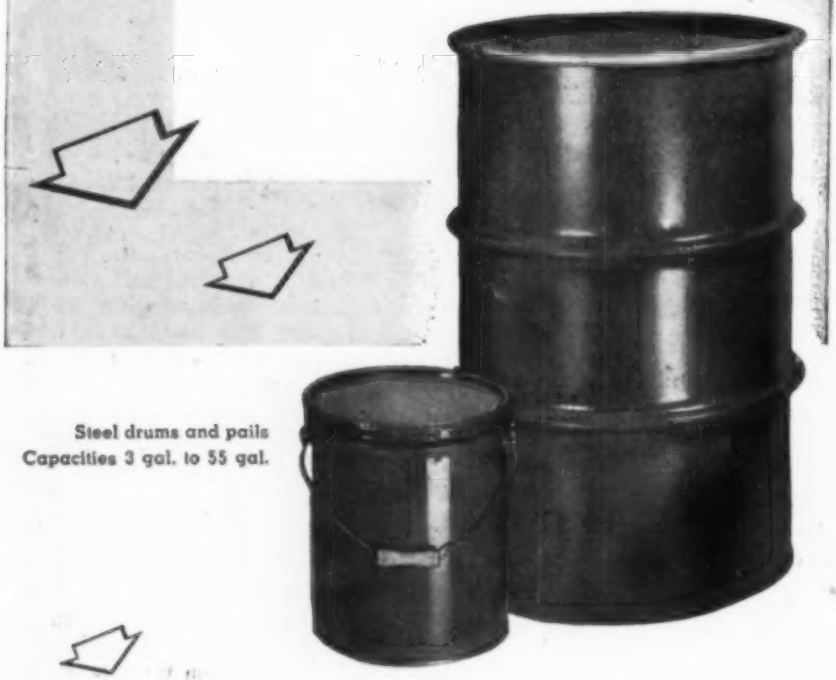
Perfumery Exposé

NATURAL PERFUME MATERIALS. *By Y. R. Naves and Mazuyer. Reinhold Publishing Corp.* 338 pages. $6.75

Reviewed by Ernest Guenther

THE MANUFACTURE of natural flower oils has always been a closely guarded and almost exclusively French industry, and only a few outsiders have succeeded in penetrating its mysteries. Aside from the inner circle of the French perfumers there are not many indeed who have had an opportunity regularly to visit Grasse, the center of the industry, or actually to work in any of the flower oil extraction plants there. The production of such oils is, moreover, a highly technical industry, requiring a profound knowledge of agriculture, methods of extraction

...the cheapest packaging is packaging that is proof against losses



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and chemistry. An occasional visit to Grasse, therefore, has resulted in little real understanding of the processes involved in this fascinating and important branch of the essential oil industry. Literature on the subject has been spotty, scattered, unreliable, even self-contradictory; frequently one writer has simply copied the errors of others.

It is, therefore, with the greatest satisfaction that this writer welcomes a reliable, comprehensive and modern study, which describes in some detail most of the important phases of the history, manufacture, analysis and evaluation of natural flower oils and resinoids. A book of only 300 pages cannot be expected to cover the whole field of essential oils; it must in some sense be restricted. Dr. Y. R. Naves and the late G. Mazuyer, two of the most competent authorities on this topic, have therefore limited the scope of their work to the natural flower oils and resinoids.

Dr. Naves was for many years director of the research laboratories of Etablissements Antoine Chiris, in Grasse, and is an outstanding figure in the science of essential oils. The present work first appeared, in French, in 1939; it has only recently been translated by Mr. Edward Sagarin.

In the preparation of the English translation, Mr. Sagarin has been most painstaking and accurate, and has checked hundreds of bibliographical references carefully.

The book is well designed and easy on the eyes—no small thing in its favor! It should be of great help to American and English perfumers, who will find it a most valuable guide through the intricacies of a highly specialized industry.

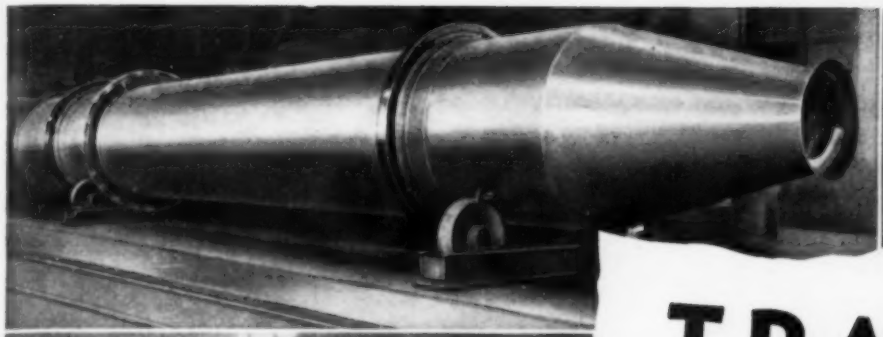
This Price Business

PRICES AND BUSINESS IN 1947. *By H. C. Kuthe. Published by the Business Bourse, New York. 271 pages, plus 7-page typewritten supplement.* $3.00.

Reviewed by Joseph A. O'Connor

THE author of this little book was born and educated in Germany, came to this country in 1922 and became engaged as a business analyst and statistician for the Synthetic Nitrogen Products Corporation. From his background as a working economist, he undertook to forecast economic trends during the latter half of 1946 and the ensuing 12 to 18 months.

Buttressed with facts and figures, the book bases its conclusions on closely knit logic. Dealing as it does mainly with monetary theory, it requires close attention. There are no



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Write for our illustrated catalog of processing equipment . . . Bulletin 2121.

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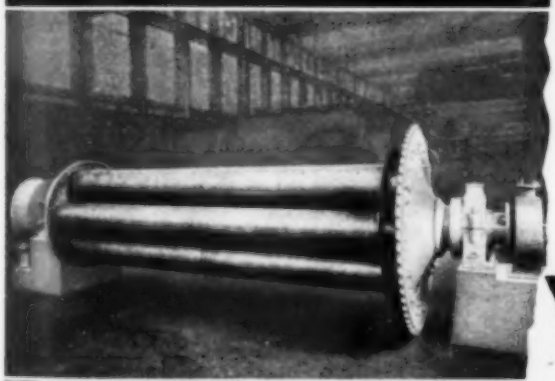

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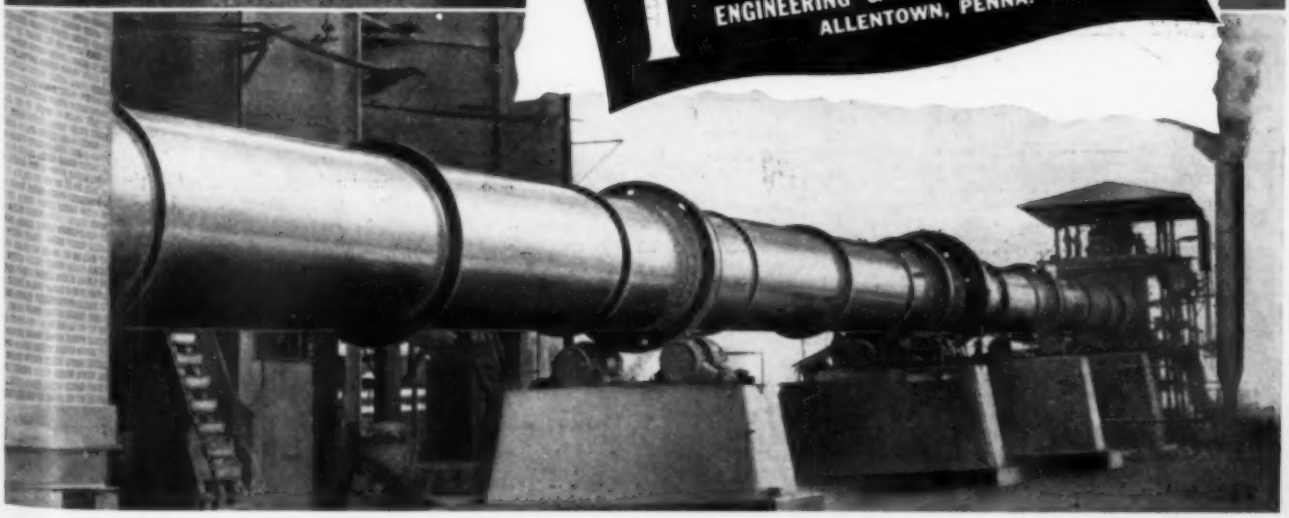

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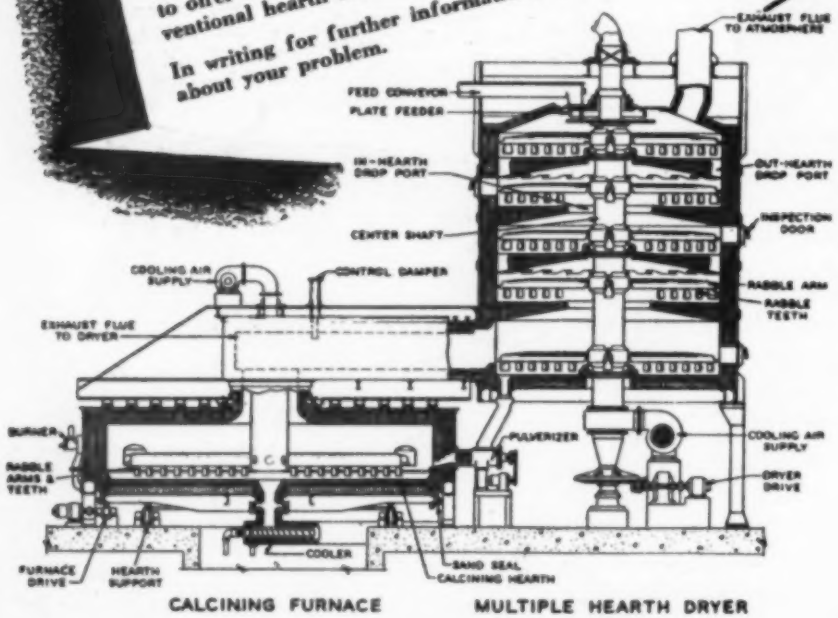
The waste heat from the calciner is used to dry and/or preheat the material feeding the calciner.

If you have any calcining or roasting job which requires a temperature ranging between 1800° and 2500°F you should investigate the Martin Calciner/Preheater. If your process calls for lower temperatures, the multiple hearth section alone with its revolving rabble arms and fixed hearth has several things to offer which are great improvements over the conventional hearth furnaces.

In writing for further information, tell us in detail about your problem.



CALCINING FURNACE MULTIPLE HEARTH DRYER

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breathing spells in the development of the thesis.

There is a three-fold division of the book: first, the forces threatening further price increases are considered, then an analysis is made of the various means of combating the inflationary threat, and finally some historic comparisons are made. There are three appendices, which will appeal chiefly to professional economists rather than general readers, detailing the amount of money hoarded in the United States, measuring the changes in money and banking to be caused by the release of the present hoardings, and giving ceiling reserves, security reserves, and sales of governmental securities to commercial banks as anti-inflationary instruments. There are eleven tables, setting forth chiefly monetary data, especially data covering circulating currency, demand deposits and hoardings.

Handicapped by its delay in publication and by the fact that its title implies that its predictions are limited to 1947, now more than half gone, this book will probably find limited circulation. Chemical Engineers and Chemists will not be strongly attracted by the book which is somewhat out of their field and handles monetary discussions in a way more familiar to economists and analysts. Perhaps not an outstanding work, "Prices and Business in 1947" is, nevertheless, a competent and well documented minority report on the impending economic activity.

BRIEFLY NOTED

Reclaimed Rubber. By J. M. Ball. Published by the Rubber Reclaimers Association, Inc. 248 pages. $5. At the wish of the Rubber Reclaimers Association, this well illustrated treatise has been prepared to present the history of the rubber reclaiming industry. It also includes material on the commercial aspects and technical processes of the industry today, as well as its wartime contributions.

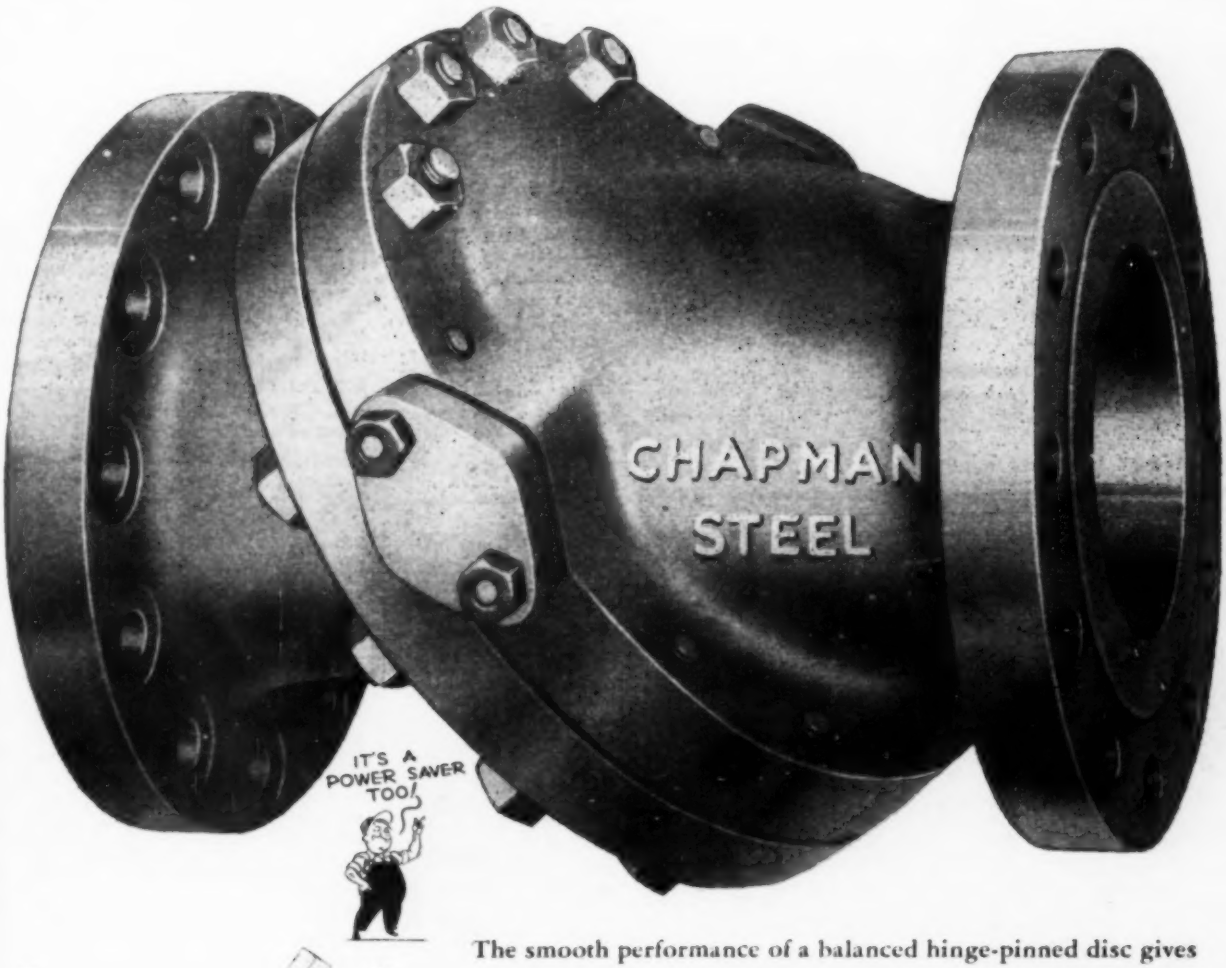
Inventions, Patents and Monopoly. By Peter Meinhardt. Published by Stevens & Sons, Ltd., 119 & 120 Chancery Lane, London W.C. 2. 352 pages. 25s. The spirit and purpose of the Patent Law in England are interpreted in this 4-part book. Part II, the longest and most detailed section, traces the development of the modern patent system and deals with the practical administration of patent law from the application for a patent to the enforcement of patent rights.

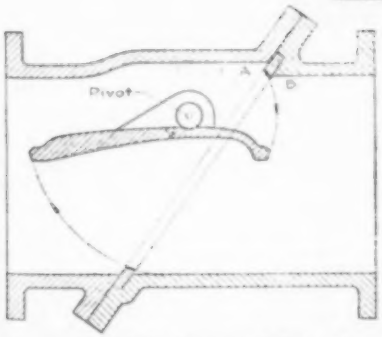
Radio-Frequency Heating. By G. H. Brown, C. N. Hoyler and R. A. Bierwirth. Published by D. Van Nostrand Co., 250 Fourth Ave., New York, N. Y. 370 pages. $6.50. By the frequent use of mathematical derivations, together with graphs

THE "CUSHIONED CLOSING" OF

CHAPMAN TILTING DISC CHECK VALVES

Prevents Water Hammer





Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

The smooth performance of a balanced hinge-pinned disc gives Chapman Tilting Disc Check Valves a quiet, "cushioned closing." There's no slamming, as in ordinary check valves, and therefore no destructive pipe-line stresses. This means that water hammer and its resultant vibrations and strains in pipe lines are eliminated.

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FLAMMABLE VAPOR DETECTOR

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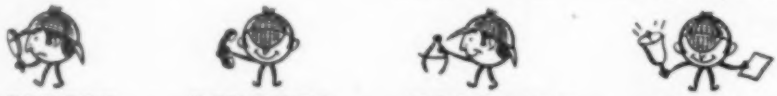

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- Vacuum Pans — Stainless Steel
- Plug Valves—Flush Type — Stainless Steel, Pure Nickel, Monel

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to convey the conclusions reached by analytical means, the principles underlying radio-frequency heating have been displayed. Experimental data gathered by the authors in the RCA laboratories and often a description of a complete laboratory experiment have been utilized.

Modern Petroleum Technology. Published by The Institute of Petroleum, Manson House 26, Portland Pl., London, W.I. 466 pages. 1£ 1s. To counteract the tendency in the petroleum industry of specialization in a particular section of it, the different chapters of this book present the various phases of petroleum technology to achieve a composite picture. Generously illustrated by cross-sectional drawings, graphs and maps, each chapter is written by an expert in his field. Drilling, production of oil, manufacture of lubricating oils, motor fuels and their utilization and aviation fuels are some of the topics covered.

Low-Pressure Laminating of Plastics. By J. S. Hicks. Reinhold Publishing Corp., New York. 161 pages. $4.50. This brief, interesting book discusses the general field of plastics, mold design, resins, catalysts, curing, reinforcements for plastics and sandwich structures including a list of materials used and physical characteristics of several of these materials. Illustrations and text describe lamination of tank covers, boat decks, and milk bottle cases; the steps followed in fabrication are listed. In addition to those items, there is a comprehensive description of steps involved in lamination including photographs of equipment used.

Bibliographie der Schweizerischen Naturwissenschaftlichen und Geographischen Literatur. Published by Schweizer Landesbibliothek. Written in German, this is a Swiss bibliography divided into four parts: the exact sciences, minerology and geology, the biological sciences and geography. It contains a section on references to Swiss periodicals, a subject index and an author index.

Directory of the Society of the Plastics Industry. Fourth edition, published by the Society of the Plastics Industry, New York. 276 pages. $3.50 to members, $4.50 to non-members. Listing the entire SPI company and individual membership, this 1947 revised edition covers this country, Canada and ten foreign countries. Included in a "Who's Who" section are the names and addresses of persons prominent in the industry. Typical products of members who are molders, extruders, fabricators and laminators are cited. Materials manufacturers, plastics machinery makers, professional and publisher members and those engaged in educational and research work are listed separately.

Essentials of Applied Physics. By R. M. Frye. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York, N. Y. 322 pages. $4.35. To satisfy the growing demand created by advanced trade schools, evening engineering schools, and junior colleges, this book presents modern physics much more concisely than the average college physics text and at the same time includes

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(illustrated above)

consists of a Conservation Vent Valve with inside Flame Snuffer and Entrainment Separator Flame Arrester. The entire unit is self contained and fully resistant to the elements. Made of pure *Aluminum*, it is non corrosive in most gases. Electrolysis is reduced as the potentials of all component parts are in equilibrium. Streamlined, easy to inspect and maintain.

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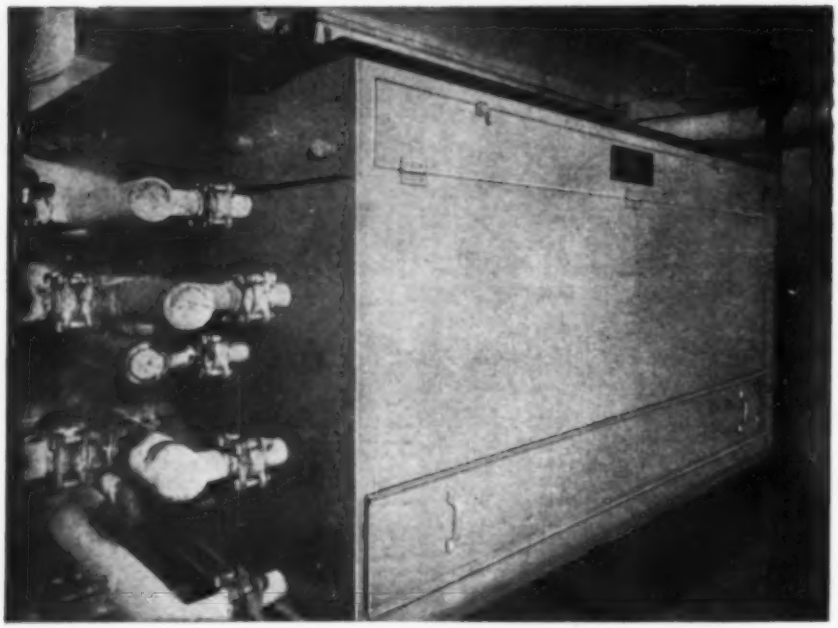

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Fundamentals of Semi-Micro Qualitative Analysis. By Carl J. Engelder. Published by John Wiley & Sons, 440 Fourth Ave., New York, N. Y. 385 pages. $3.50. Professor Engelder has rearranged the qualitative course to permit closer correlation of student progress in classroom and laboratory. In both places (theory and practice) the text will fulfill the requisites of a guide in an exceedingly important undergraduate subject.

RECENT BOOKS and PAMPHLETS

Tacoma Statistics 1946. Published by Tacoma Chamber of Commerce, Tacoma, Wash. 24 pages. Gratis. Statistical presentation of Tacoma including major industries, chemical, metallurgical, etc. Mimeographed.

It's Your Top Soil. Published by American Steel and Wire Co., Rockefeller Building, Cleveland 13, Ohio. 18 pages. Gratis. Covers contour plowing, terracing, strip cropping, gully elimination, crop rotation and woods preservation. Illustrated with sketches and photographs.

Toulmin's Trade-Mark Act of 1946. 1947 Supplement, published by The W. H. Anderson Co., Cincinnati, Ohio. 88 pages. Contains rules of practice and forms in trade-mark cases, effective July 8, 1947. Includes quick-reference index.

The Valley of Industrial Opportunity. Published by The Ohio Power Co., Canton 2, Ohio. 12 pages. Describes industrial advantages of the Southeastern Ohio river valley. Discusses available water supplies, markets, industrial minerals and fuels.

Bibliography of References to the Literature on the Minor Elements and Their Relation to Plant and Animal Nutrition. Seventh Supplement to the Third Edition. Compiled and published by the Chilean Nitrate Educational Bureau, 120 Broadway, New York, N. Y. 121 pages. Lists abstracts and references largely obtained from Chemical Abstracts and the Experiment Station Record. Includes four indices—general, author, botanical and animal nutrition.

Aqua Ammonia. Chemical Safety Data Sheet SD-13, published by the Manufacturing Chemists' Association, 603 Woodward Bldg., Washington 5, D. C. 16 pages. 20 cents. Deals with the safe handling and use of aqua ammonia.

Tables of Selected Values of Chemical Thermodynamic Properties. Published by the National Bureau of Standards, Washington 25, D. C. In loose leaf form to facilitate adding supplements, these tables bring together all available data on chemical thermodynamic properties for the first time.

Hardenability of Alloy Steels. Published by the American Iron and Steel Institute, 350 Fifth Ave., New York 1, N. Y. 146 pages. Revised edition of No. 11 in a series entitled "Contributions to the Metallurgy of Steel." Contains four parts—Tentative Hardenability Bands Applicable when H Steel Chemistry is Specified, Selection of Automotive Steel on the Basis of Hardenability, Standard End-Quench Hardenability Test Procedure and Hardness Conversion Numbers.

Carbon Disulphide. Chemical Safety Data Sheet SD-12, published by the

How is the CRF* *in your plant?*

CRF . . . *corrosion resistance factor . . . is a critical point in many of today's process operations. Equipment inadequately protected against corrosion means costly shutdowns . . . and expensive subsequent replacements. In those processing steps involving liquid-solids separation, this troublemaker can be eliminated by the use of Dorr equipment pecifically fabricated to provide continuing resistance to acid or abrasive slurries at room or elevated temperatures. Here is how it has been done for others.

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To treat highly corrosive solutions in phosphoric acid manufacture.

SOLUTION:

Specially designed Dorr Agitator and Thickener mechanisms of wood were supplied for wood tanks.

2

PROBLEM:

To separate catalyst from oil processed by cat-cracking, handling corrosive solution at 300-500° temperature under slight pressure.

SOLUTION:

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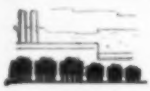
3

PROBLEM:

To recover wood fibre waste from weak formic acid.

SOLUTION:

A 170′ Dorr Thickener fabricated with stainless steel feedwell and rake blades; all other mechanism specially constructed for application of acid resistant paint.



4

PROBLEM:

To handle roasted zinc concentrates in corrosive sulphate solution for preparation of electrolyte for electrolytic zinc process.

SOLUTION:

Special Dorr Agitators furnished with wood mechanisms for dissolution and copper mechanisms for electrolytic preparation.

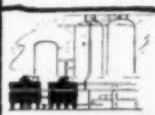
5

PROBLEM:

To wash counter-currently sodium sulphate from a nickel hydrate salt precipitate with a limited amount of water.

SOLUTION:

Special Dorr Multideck Classifier of copper construction.



6

PROBLEM:

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SOLUTION:

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Manufacturing Chemists' Association, 608 Woodward Bldg., Washington 5, D. C. 12 pages. 20 cents. Deals with safe handling and use of carbon disulphide.

Bibliography and Index. Published by the Office of Technical Services, Department of Commerce, Washington 25, D. C. 109 pages. 75 cents. Lists all numbered reports published by the Office of Scientific Research and Development on wartime technical problems.

Science, Government and Industry. By Edward V. Appleton. Published by Arthur D. Little, Inc., Memorial Drive, Cambridge, Mass. 38 pages. The first Arthur D. Little Memorial Lecture.

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GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publications noted in this list always give complete title and the issuing office. Remittance should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the bureau responsible for its issue.

China Clay or Kaolin. U. S. Tariff Commission, War Changes in Industry Series, Report No. 23. Price 25 cents.

Safety Manual for Operation of Copolymer Laboratories, Second Edition. Reconstruction Finance Corporation, Office of Rubber Reserve. Price 25 cents.

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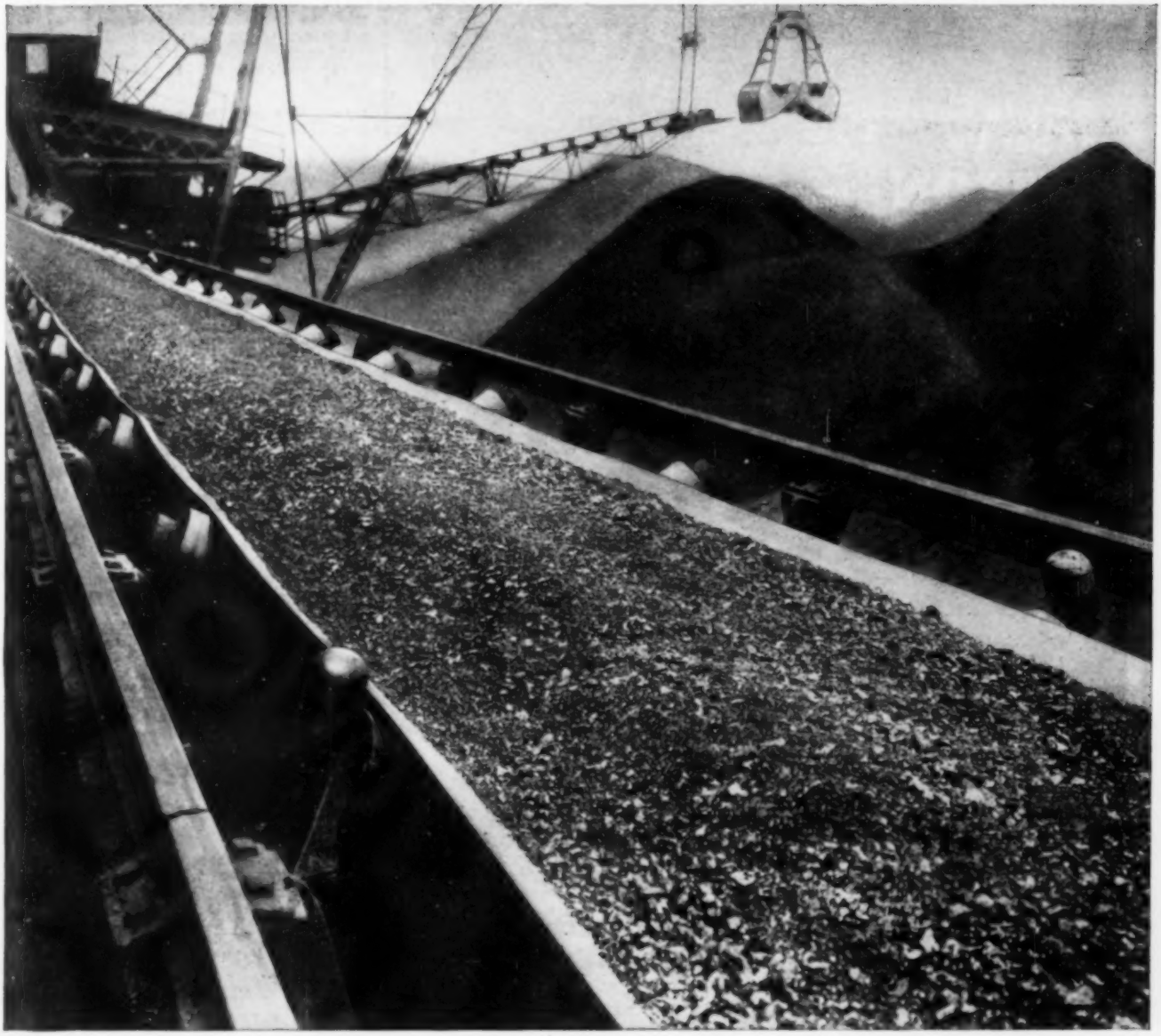

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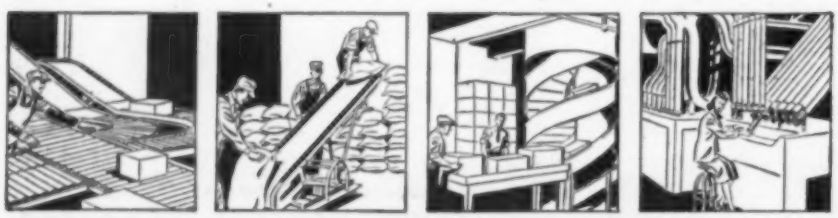

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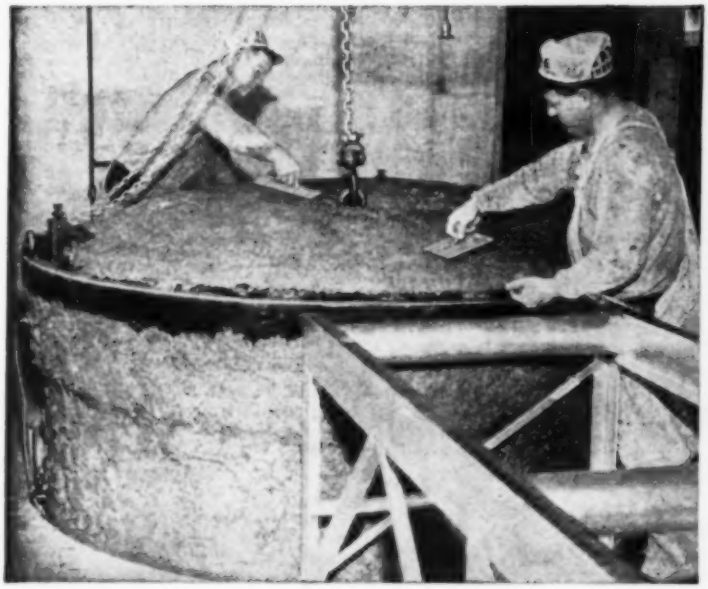

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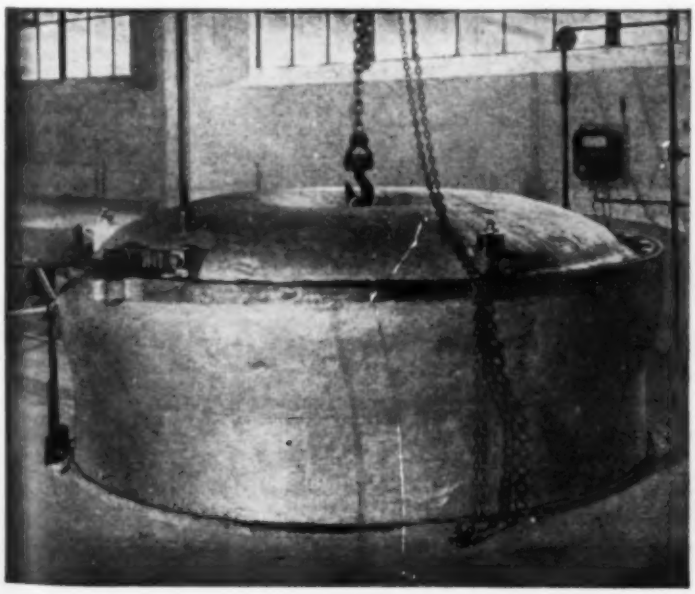

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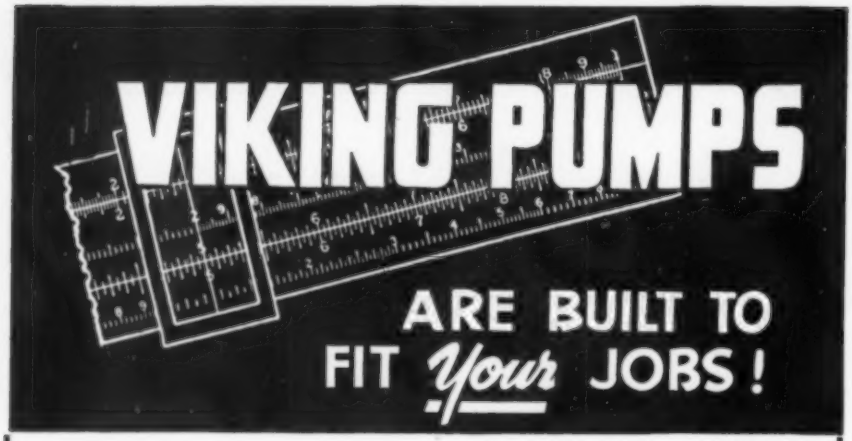

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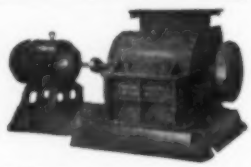

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A Glossary of the Mining and Mineral Industry. By Albert H. Fay. Bulletin 95, Department of the Interior. Republication of a dictionary containing some 20,000 technical and local terms. Price $1.75.

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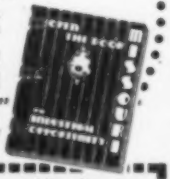

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(Continued from page 164)

114. Chemicals. B. F. Goodrich Chemical Co., Cleveland 15, Ohio—Bulletin 47-SD1, 6-page loose-leaf report on 2-aminoethyl sulphuric acid, a new product of this company, giving physical and chemical properties in detail. Presents reactions showing its use as an organic intermediate.

115. Instruments. Askania Regulator Co., Chicago, Ill.—Bulletin No. 135. 16-page booklet covers the line of gas regulators manufactured by this company. Includes diagrams showing the use of each of the various models.

116. Dehumidifiers. Pittsburgh Lectrodryer Corp., Pittsburgh 30, Pa.—The first two bulletins in a series on dehumidification problems have been released by this company. The first discusses water in pneumatic controls and the second the entrance of moisture into storage tanks.

117. Chemicals. Hercules Powder Co., Wilmington 99, Del.—12-page booklet describing the chemical nature of Dresinol, one of a series of rosin and resin emulsions newly developed by this company. Explains how it may be used as a selective plugging agent in secondary recovery of oil by water flooding.

118. Electrical Equipment. The Superior Electric Co., Bristol, Conn.—12-page booklet featuring the variable transformers and automatic voltage regulators manufactured by this company. Contains ratings, detail drawings, photographs and performance and engineering data.

119. Process Equipment. Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.—32-page booklet describes and pictures the use of this company's machinery in different industries, such as in the transportation, construction, public works, petroleum and chemical industries.

120. Compressors. Norwalk Co., Inc., South Norwalk, Conn.—32-page catalog presents information on this company's line of compressors, two conversion tables and a page of equivalents used in the processing industries. Includes photographs of the various models.

121. Chemicals. Carbide and Carbon Chemicals Corp., New York 17, N. Y.—32-page revised edition of the booklet, "Solvent Recovery by the Columbia Activated Carbon System," explaining how solvent recovery systems work, what equipment is used, the costs of operation and recommended industrial applications.

122. Instruments. The Hays Corp., Michigan City, Ind.—8-page pamphlet describes principle of operation of the variety of meters manufactured by this company. Includes cut-away drawings.

123. Water Treating. Liquid Conditioning Corp., Linden, N. J.—Bulletin 10. 2-page leaflet on prevention of scale formation and corrosion in the water used for equipment cooling.

124. Valves. American Car and Foundry Co., New York 8, N. Y.—8-page pamphlet describing and illustrating the line of

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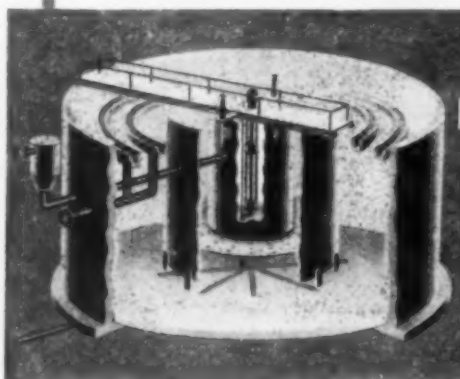

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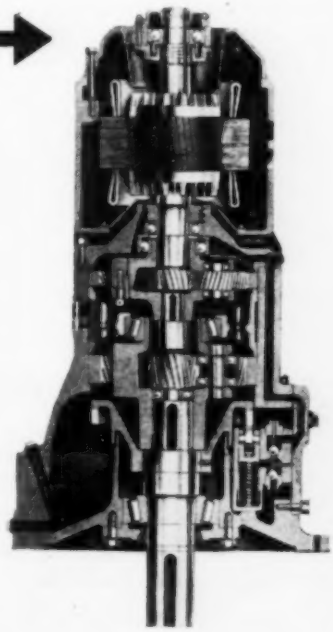

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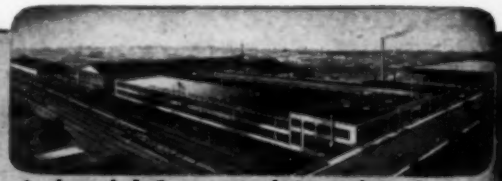

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Read What Mr. Burt Sheehan, Plant Engineer of the Preservative Paint Co., Seattle, Washington, says about their Roper Installation.

● "Our product, Plastic Leak-Tite, is a heavy roof putty for stopping leaks on asphalt roofs and around flashings. ● Containers were previously filled by hand with a putty knife and scoop. ● With the Roper Pump installation we now fill in one hour the same number of containers that were formerly filled in six hours. ● In addition to the saving of time, the operation is very much cleaner and neater."

SOLVING ONE OF THOSE "IMPOSSIBLE" JOBS!

Another example of Roper engineering solving one of those so-called "impossible" jobs . . . transferring a heavy viscous roofing compound at a maximum speed of 16 g.p.m.
The Roper Pump is mounted with a 3 h.p. motor, backgearing and 4-speed transmission on an Air Corps bomb truck so as to facilitate moving the equipment from one batch mixer to another.
Let Roper engineering help solve your pumping problems!

Send For Bulletin Get all of the facts on the Roper line. There is a model and size for nearly every industrial requirement. Capacities from ¼ to 300 g.p.m.; pressures up to 1000 p.s.i.

GEO. D. ROPER CORP.
149 Blackhawk Park Ave.
ROCKFORD, ILLINOIS

ROPER *Rotary Pumps*

Sales Offices in Principal Cities

lubricated plug valves manufactured by this company. Contains tables giving size, ends, operation, working pressures and test pressures for each.

125. Rubber Belting. The B. F. Goodrich Co., Akron, Ohio—12-page catalog listing commonly used sizes of belting, minimum pulley diameters for various grades made by this company and their horsepower capacity. Includes a table of service factors of prime movers, rules for determining the horsepower, the formula for finding the arc of contact, length of open drive and crossed endless belts, correct lengths to cut belts and belt speeds.

126. Materials Handling. Trackson Co., Milwaukee 1, Wis.—Folder picturing the uses of this company's Traxcavator, an earth-moving, materials-handling machine, and listing facts about its construction and operating features.

127. Cosmetics. L. Sonneborn Sons, Inc., New York 16, N. Y.—A file folder having on the outside technical data on white oil and petrolatum for cosmetic creams.

128. Cleaners. Gaybex Corp., Newark 5, N. J.—4-page flyer listing and describing the line of cleaners made by this company.

129. Chemicals. Pittsburgh Plate Glass Co., Pittsburgh 22, Pa.—Describes this company's new granular germicide and disinfectant essentially composed of a stabilized calcium hypochlorite.

130. Instruments. Fisher Governor Co., Marshalltown, Iowa—Bulletin F-1A. 4-page leaflet describing a pilot or relay which incorporates a micrometer type level setting.

131. Welding. Midwest Piping & Supply Co., Inc., St. Louis 4, Mo.—Bulletin 47-1. 8-page booklet picturing and giving dimensions for the line of stainless steel welding fittings made by this company.

132. Safety Equipment. Davis Emergency Equipment Co., Inc., Newark, N. J.—Bulletin 1142. 4-page leaflet describes this company's gas alarm system. Includes a full page schematic diagram showing the relationship of the units of the system.

133. Equipment. The Babcock & Wilcox Co., New York 6, N. Y.—Describes B & W's equipment for steam separation in boiler drums. Operation is shown together with illustrations of applications in several types of boiler units.

134. Pumps. Allis-Chalmers, Milwaukee 1, Wis.—Bulletin 52B6691. 4-page leaflet telling of the operating and construction features of the new line of pedestal type centrifugal pumps made by this company. Dimension tables, pump-motor-drive tables and head-capacities tables are presented.

135. Equipment. Vulcan Iron Works, Wilkes-Barre, Pa.—Bulletin No. A-442. 28-page booklet describing and illustrating the operating principle and fundamental design of the rotary kilns, coolers, dryers and other processing equipment made by this company.

136. Water Treating. Allis-Chalmers, Milwaukee 1, Wis.—Bulletin 28B6611. 12-page booklet explaining and diagraming the essential function of a hot process water conditioning system. Included is a description of the design of the equipment used, made by this company. Describes operation of this system.

137. Chemicals. Ansul Chemical Co., Marinette, Wis.—4-page bulletin comparing efficiency, concentration, purity, etc., of a typical sulphur burning operation with the use of liquid sulphur dioxide.

138. Glass Specialties. Fisher & Porter Co., Hatboro, Pa.—4-page catalog describing the company's line of precision bore glass specialties. Illustrated are many special shapes made to specification.

139. Motors. Electric Machinery Mfg. Co., Minneapolis 13, Minn.—Provides two clearly labeled cutaway views of the line of two-pole, squirrel-cage induction motor manufactured by this company.

140. Oil Burners. The Babcock & Wilcox

ONE *recognized standard*

THE COTTRELL PROCESS OF ELECTRICAL PRECIPITATION

FOR GAS CLEANING, smoke abatement and removal of dust, fume, tar and other suspended matter from gas, there has been one universally accepted process for more than thirty years. In answer to your special problem, a Cottrell installation incorporating this rich experience in research, development and worldwide operation means the complete fulfillment of your requirements.

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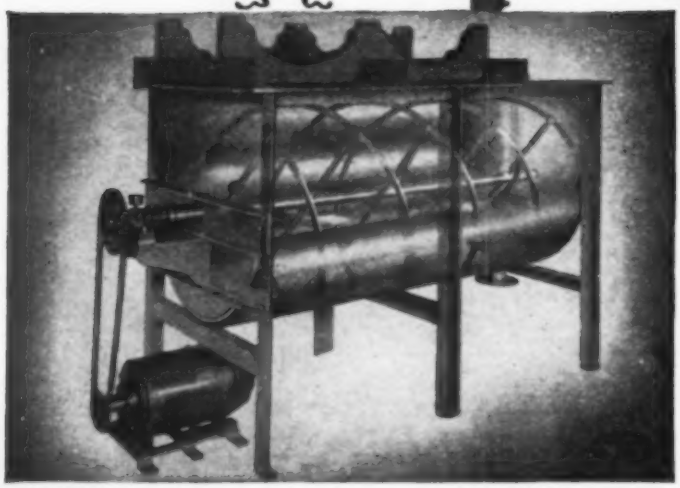
Custom Built to Your Specifications



Planning new corrosion resistant processing equipment? Keep in mind that between blue print and finished vessel the experience, skill and plant of your fabricator may determine how much return you get from your investment—how long and how well it will serve in your plant for your special applications.

We are specialists in stainless steel and alloy fabrication – work exclusively with these metals. Our experienced staff of engineers and mechanics – the special tools, dies and machinery we use – give you increased returns from your expenditures for stainless steel equipment. Consult with us.

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S. BLICKMAN, INC.

Guards Alloys in Fabrication

SEND FOR THIS VALUABLE BOOK

A request on your letterhead will bring our guide, "What to Look For When You Specify Stainless Steel for Your Processing Equipment."

CORROSION RESISTANT PROCESSING EQUIPMENT

TANKS • KETTLES • STILLS • HEAT EXCHANGERS • AGITATORS • MIXERS • TOWERS • PIPING

FOR MORE INFORMATION

See Reader Service Coupon on pages 163-164

Co., New York 6, N. Y.—Describes the construction and application of this company's Wide Range Y-Jet Steam Atomizing Oil Burner.

141. Chemicals. Carbide and Carbon Chemicals Corp., New York 17, N. Y.—18-page booklet presenting the properties, specifications and uses of a group of polyethylene compounds made by this company.

142. Engineering Data. Leslie Co., Lyndhurst, N. J.—Bulletin 467, 12-page booklet of reference tables covering the properties of saturated steam and including a pressure-drop steam flow chart, oil flow-friction-viscosity chart, an approximate hardness conversion table, a material selection chart and others.

143. Magnetic Separators. Stearns Magnetic Mfg. Co., Milwaukee 4, Wis.—Bulletin No. 120-B. Explains this company's magnetic screen filter separator for problems requiring the removal of iron or steel particles from liquids. Describes open and closed circuit types with capacity and other specifications.

144. Instruments. The Bristol Co., Waterbury, Conn.—Bulletin No. T835. 16-page booklet describes and pictures a new line of recording thermometers and gauges made by this company. Gives information covering chart ranges, chart drives, thermometer bulbs and measuring elements.

145. Flameproofing. The B. F. Goodrich Co., Akron, Ohio—4-page folder giving information on the physical properties of the series of compounds made by this company for flameproof fabrics.

146. Corrosion. The Duriron Co., Inc., Dayton 1, Ohio—4-page bulletin dealing with the presence of copper as a possible solution contaminator in corrosion-resisting alloys.

147. Detergents. Onyx Oil & Chemical Co., Jersey City 2, N. J.—4-page data sheet on this company's line of emulsifying dispersing detergents covering suggested uses, specific performance data and chemical and physical characteristics.

148. Metal Products. Lee Metal Products Co., Inc., Philipsburg, Pa.—4-page flyer describing coil tanks and multiple-tank units made by this company. Contains table of specifications.

149. Heaters. The Babcock & Wilcox Co., New York 6, N. Y.—16-page bulletin describing and illustrating the types of tubular air heaters available from this company.

150. Trucks. The Rapids-Standard Co., Inc., Grand Rapids 2, Mich.—2-page flyer illustrating and describing the line of steel hand trucks put out by this company.

151. Instruments. North American Philips Co., Inc., New York 17, N. Y.—4-page folder entitled "Geiger-Mueller Counters Applied to Mining". Explains the theory and details of construction and operation.

152. Deaerators. Cochrane Corp., Philadelphia 32, Pa.—Revised bulletin explaining the operating principle of this company's atomizing deaerator.

153. Brass Rods. Titan Metal Mfg. Co., Bellefonte, Pa.—4-page flyer describing large diameter brass rods manufactured by this company. Includes tables showing maximum lengths of rods in various diameters, composition of the alloys in which they are furnished and A.S.T.M. and S.A.E. specification for these alloys.

154. Market Research. Foster D. Snell, Inc., New York 11, N. Y.—8-page booklet outlining forms of market research done by this company.

155. Safety. National Conservation Bu-

HOW THEY DO GET AROUND!

Reading-Pratt & Cady BAR STOCK VALVES

They were first introduced by R-P & C as close control valves. But these tough little globe and angle valves have such a wide pressure and temperature range — give satisfactory service in so many kinds of applications — that many users think of them as general purpose valves.

Reading-Pratt & Cady Bar Stock Valves are precision-machined from highest quality bar stock—bronze, carbon steel or alloy steel. Working pressures range from 4000 pounds at 150°F. to 475 pounds at 1000°F.

DESCRIPTIVE CATALOG. Send for our new catalog which describes the advantages and limitations of R-P & C Bar Stock Valves. Just write for DH-766.

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READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

FILTER UNITS
by MULTI-METAL

THE superior construction and improved materials of Multi-Metal Filter Units give longer, more trouble-free service resulting in increased production. In addition, because of their advanced design, Multi-Metal Filter Units often can greatly improve the efficiency of existing processing installations.

The skill and experience gleaned from 35 years of intensive specialization are at your service when you place your process problems in the hands of Multi-Metal experts.

Send for free catalog and wire cloth samples, or send prints and specifications for an immediate quotation.

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THE DEMPSTER-DUMPSTER SYSTEM OF MATERIALS HANDLING not only permits the use of any number of detachable bodies to be serviced by one truck hoisting unit, but you can have any special type of body you need to meet your particular requirements to do the job quicker, easier and at far less cost. Many different types of bodies, four of which are pictured at left, are built for handling every conceivable type of materials from light, bulky to extremely heavy, as well as for liquid or dust. Capacities 1½ to 10 cu. yds. and up to 8 Tons pay load.

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DEMPSTER BROTHERS, INC.
197 Springfield, Knoxville 17, Tennessee

reau, New York 7, N. Y.—Provides advice on how to lift heavy objects safely.

156. Office Machine. General Aniline & Film Corp., Johnson City, N. Y.—20-page booklet explaining use of new duplicating machine of this company.

157. Blow Torch. The Birk Manufacturing Co., East Hartford, Conn.—1-page flyer on dry fuel blow torch using fuel tablets put out by this company.

158. Inter-office Communications. Executone, Inc.—8-page booklet on this company's sound system for inter-office and office-plant communication.

159. Instruments. Radio Corp. of America, Camden, N. J.—2-page folder illustrating and describing this company's vacuum gage.

160. Fire Proofing. Wm. E. Hooper and Sons Co., Philadelphia, Pa.—12-page booklet showing uses of fire-resistant canvas made by this company.

161. Resins. American Cynamid Co., Bound Brook, N. J.—32-page booklet displaying the uses of a new melamine resin developed by this company for shrinkage control of wool.

162. Cleaning Equipment. Ideal Industries, Inc., Sycamore, Ill.—2-page flyer put out by this company on their electric cleaner-blower.

163. Western Markets. Metropolitan Oakland Area California, Oakland 12, Calif.—52-page booklet entitled "How to Win the Markets of the New West," discusses the industrial advantages offered by this area.

164. Cleaners. Safety and Maintenance Co., New York 1, N. Y.—6-page folder picturing the steps in the production of this company's floor cleaner.

165. Cabinets. Standard Steel Equipment Co., Inc.—4-page leaflet describing the line of lockers and cabinets put out by this company.

166. Textile Chemicals. American Cyanamid Co., Bound Brook, N. J.—A paper, "Studies of Wool Dyeing: Crocking," covers a wide range of wool dyes to report the effects of intensity of the crock and incomplete scouring, the presence of dye solvents, hard water, drying, shearing, chlorination, Glauber's salt, temperature, pH and dye contraction.

167. Piping. Northern Indiana Brass Co., Elkhart, Ind.—Describes the line of industrial nickel alloy piping and fittings made by this company.

168. Power-Transmission Equipment. The American Pulley Co., Philadelphia 29, Pa.—Features tables and charts for use in selecting the proper size sheaves for desired range of speed. Shows construction details and suggests applications for this company's line of drives.

169. Equipment. Dresser Industries, Inc., Cleveland 13, Ohio—112-page bound book identifying the various subsidiaries of Dresser Industries, discussing what they make and how they operate, attractively put together and plentifully illustrated with photographs and cross-sectional drawings.

170. Equipment. Economy Co., Inc., New York 17, N. Y.—32-page booklet listing overhead cranes, steel buildings, crane runways, shovels, cranes, draglines, truck cranes electric motors, transformers and power units available from this company.

171. Metal Specialties. Magna Mfg. Co., Inc., New York 22, N. Y.—4-page leaflet listing grades of aluminum powder, aluminum paste and bronze powder manufactured by this company.

172. Steel. Joseph T. Ryerson & Son, Inc., Los Angeles 54, Calif.—12-page booklet giving picture story of the stocks and facilities at this company's newest plant in Los Angeles.

173. Powder Filling Machinery. Harold W. Baker Co., Bryn Mawr, Pa.—6-page folder listing types of filling machinery made by this company and specifications.

174. Equipment. The Bunell Machine & Tool Co., Cleveland 14, Ohio—8-page booklet entitled "Clearing Away Misunderstandings, Standard Vs Special Machines."

CHEMICAL ECONOMICS

H. M. Battors, MARKET EDITOR

CHEMICAL PROCESS INDUSTRIES SPEED UP ACTIVITIES FOLLOWING A LET-DOWN IN SUMMER MONTHS

FOR THE FIRST time in several years seasonal influences have been reported as a factor in industrial production. From the latter part of June throughout the hot-weather period, many plants in the chemical process industries operated below capacities. In some cases plants were closed temporarily in order to give an opportunity for long-deferred overhauling of equipment. In addition, there was an almost universal observance of vacation periods with an accompanying curtailment of the working force. As a result, the third quarter got off to a rather faltering start but more recently, the trend was reversed and some of the basic industries already are back to, or ahead of, the high levels reached in the earlier part of the year.

With production data for the first six months now available it is possible to make precise comparisons with previous periods and the comparison is very much in favor of the present year. The output of sulphuric acid is reported as 4,973,715 tons and if this production rate is maintained over the remainder of the year, the twelve-month total would draw close to 10,000,000 tons or more than the combined government and private plants produced at their wartime peak. Soda ash, which still is listed as scarce, was turned out in the first half of this year at an average monthly rate of 397,000 tons or about 4,000 tons a month ahead of the record rate set in 1944. The rise in ash production has come largely from expansion in the natural ash branch which promises to become still more important as a new deposit is being opened up in Wyoming.

Most of the other heavy tonnage chemicals have been going forward at their highest peacetime rates. This has been due partly to the fact that labor troubles and work stoppages were much less prevalent this year than in the first half of 1946 and partly because of reconditioning of old equipment and the addition of new capacities. The significance of the improved position of chemical manufacturers lies in the assurance given to the process industries that they may establish production schedules based on a growing supply of raw materials.

The outlook for chemicals for the second half of this year is favorable even though some curtailment of export trade may occur. In the first place, productive facilities have been broadened and, equally important, consuming industries appear to be in a position where they can readily absorb the full volume of chemical production. What lies directly ahead for the paper trade may be inferred from a report issued last month by the Department of Commerce which states that with additional pulp, paper and board capacity coming into operation in future months, the time appears to be fast approaching when most all domestic requirements will be met and wholesalers' and converters' inventories replenished. This may take several more months unless total economic activity should recede materially. Even then there may still remain a substantial foreign demand which could be met by domestic mills if export interest is aroused.

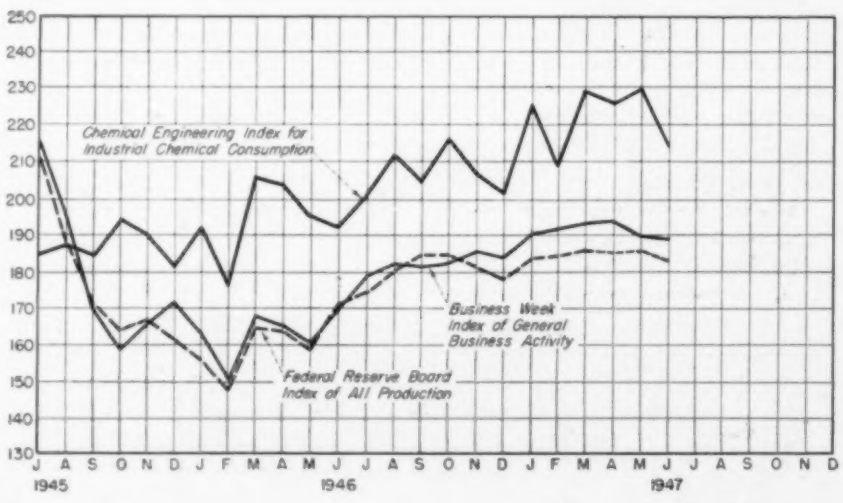
Prospects for new building have brightened which reflects directly upon the outlook for paints and flat glass. Incidentally, production of plate glass in July dropped to 17,670,240 sq. ft. with vacation shutdowns of plants and the long Fourth of July holiday period accounting for the decline. Demand for refined petroleum products is running at a record pace and refineries are working at their highest rate. Steel mills were less active in July but the figures for August compare favorably with those for May.

Production of synthetic rubber has been dropping steadily each month with the June output amounting to 35,697 long tons compared with 62,103 long tons last January. Consumption of the synthetic product likewise has declined and in June, for the first time since production of synthetic became substantial, preference was given to natural rubber, the consumption totals for that month being 42,541 long tons of natural, 42,358 long tons of synthetic. It is probable that as restrictions on use are further modified, the trend toward greater use of natural will be accelerated.

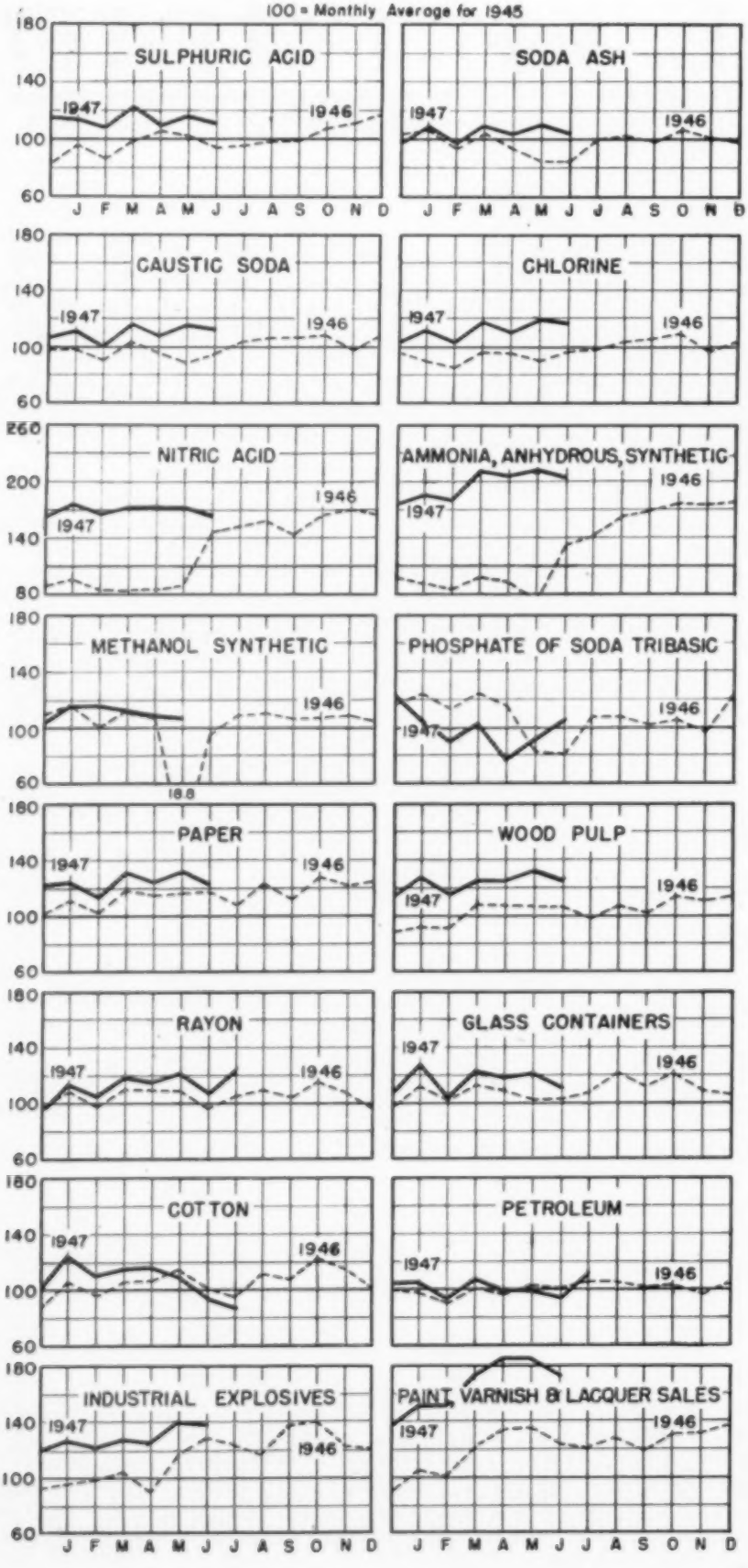
Chemical Engineering Index
Industrial Consumption of Chemicals

1935=100

	May Revised	June
Fertilizers	53.35	47.97
Pulp and paper	23.60	22.35
Petroleum refining	19.86	19.94
Glass	23.80	21.62
Paint and varnish	27.42	25.60
Iron and steel	13.40	12.70
Rayon	23.01	20.56
Textiles	11.33	10.05
Coal products	10.10	9.87
Leather	4.50	4.40
Explosives	7.50	7.47
Rubber	5.85	5.35
Plastics	7.08	6.63
	230.80	214.51



PRODUCTION AND CONSUMPTION TRENDS



PERHAPS THE best way to follow the trend of the chemical industry is to keep informed on expansion programs and interpret them in terms of production and consumption growth. For the first seven months of this year, the chemical process industries awarded contracts for new plants to the extent of something in excess of $176 million and announced plans for projected building in the amount of approximately $326 million. The total expenditure as represented by contracts awarded is less than had been originally contemplated but in many cases plans have been deferred rather than abandoned. However, the programs now being carried into execution involve an appreciable amount and give evidence of the expanding nature of consuming requirements.

Because no Census of Manufactures has been taken since 1939, complete data for later years are not available but there has been made public sufficient information on basic raw materials and on various manufacturing lines to permit of industry-wide projections with the assurance that they represent a fair approximation of the current position of the chemical process industries.

From 1939 to the present the production curve has moved almost continuously upward with all lines sharing in the expansion although the rate of growth shows rather extensive industry variations. In 1939 the chemical process industries turned out products with a reported value of $11.1 billion. At the 1947 rate this total would be doubled and with adjustments for increased prices the process industries this year should produce goods to a value of about $27 billion.

While these industries cover a wide and varied range in the industrial field they have a common bond inasmuch as all make use of chemicals somewhere in their manufacturing operations. Therefore, expansion programs in the chemical process industries have a direct bearing on chemical production because the volume of chemicals made available for use must be attuned to the needs of the consuming outlets.

Current trend in the process industries is upward. The Federal Reserve Board reports that in July industrial production dropped which makes the fourth consecutive month the Board's index has declined. It was added however that the drop between June and July was due in part to influences of a temporary nature and a somewhat higher level is indicated for August.

ALLIS-CHALMERS ANNOUNCES A

New Small Pump

OF UNUSUAL VERSATILITY

THE NEW *"Pedrifugal"
Pedestal Type
CENTRIFUGAL PUMP

HERE'S A BRAND NEW addition to the Allis-Chalmers line of fine centrifugal pumps!

* It's small, compact, efficient — offers endless variations in capacity and head — suits a hundred jobs — fills a long-felt need.

* It's economical to buy and operate — soundly engineered in every detail — built to highest standards of materials and workmanship.

* It's backed by Allis-Chalmers 65 years of engineering leadership in building centrifugal pumps!

Allis-Chalmers new "Pedrifugal" pump is made in 1" by 1", 2" by 2" and 3" by 3" sizes—capacities to 500 gpm—heads to 100 ft.—up to 15 hp. Ask your nearest Allis-Chalmers office or dealer for the new "Pedrifugal" Pump Bulletin 52B6691. A2305

ALLIS-CHALMERS, MILWAUKEE 1, WIS.

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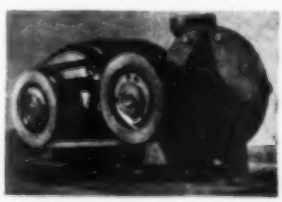


Buy It "Off the Shelf"

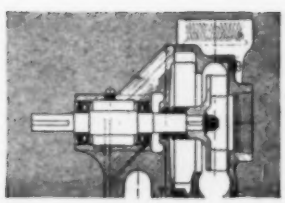
Pump can be bought "bare" or as a complete unit; pump, motor, Texrope drive and welded steel base. Also can be coupled or belted to a motor, a gasoline engine or power take-off.

V-Belt Drive Gives Great Range of Capacity

Specially designed for flexible TEXROPE V-belt drive. Changing one sheave quickly changes speed and capacity of the pump . . . gives great flexibility.

Designed and Built for Simplified Maintenance

All moving parts quickly accessible without disconnecting pipes. No packing rings to replace . . . bearings have 3 to 5 year supply of grease under normal operation.



High Grade Construction

Two large ball bearings, grease sealed. . . . High grade mechanical shaft seal. . . . Heavy 1 in. machined shaft, with key ways and impeller lock nut. . . . Bronze open type impeller. . . . Heavy, generous design.

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One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

Have you heard of these APPLICATIONS of the SUTTON, STEELE & STEELE AIR TABLES ?

1. Separation of catalysts?
2. Separation of bone char?
3. Separation of filtering medium?
4. Separation of silica gel?
5. Separation of prills from slag?
6. Separation of plastics?
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The above represents only a few of either the new and novel or old and tried applications of the Sutton, Steele & Steele Air Table in the chemical engineering industry.

• **Our engineers will be glad to help solve your separating or concentrating problems and submit recommendations. Send sample for laboratory tests.**

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SSS PROCESS FOR BETTER PRODUCTS—FASTER

United States Production of Certain Chemicals

June 1947, June 1946 and Six-Month Totals for 1947 and 1946

Tons, unless otherwise noted	June 1947	June 1946	Total, Five Months 1947	Total, Five Months 1946
Ammonia, synthetic, anhydrous[1]	91,681	60,609	545,438	263,871
Ammonium nitrate (100% NH_4NO_3)	85,655	62,445	526,593	241,823
Ammonium sulphate, synthetic, technical (M lb.)	33,602	19,738	189,841	151,658
Calcium arsenate ($Ca_3(AsO_4)_2$) (M lb.)	8,805	4,116	21,146	14,265
Calcium carbide, commercial	48,136	43,124	304,804	249,867
Calcium phosphate: (M lb)				
Monobasic (100% $CaH_4(PO_4)_2$)	4,253	5,233	33,899	33,779
Dibasic (100% $CaHPO_4$)	7,304	5,670	39,339	40,642
Carbon dioxide: (M lb.)				
Liquid and gas	22,987	16,774	110,289	101,897
Solid	73,713	61,771	337,026	302,824
Chlorine, gas	117,486	96,420	673,664	552,119
Chrome green (M lb.)	1,162	1,322	7,014	9,995
Chrome yellow and orange (M lb.)	4,540	2,928	23,730	23,926
Hydrochloric acid (100% HCl)	33,071	27,438	210,710	161,060
Hydrogen (M cu. ft.)	1,690,000	1,375,000	9,739,000	8,270,000
Lead arsenate, acid and basic (M lb.)	1,289	4,874	23,571	43,092
Molybdate chrome orange (M lb.)	305	365	2,332	2,566
Nitric acid (100% HNO_3)	62,064	55,418	382,156	216,058
Oxygen (M cu. ft.)	1,088,000	869,000	6,751,000	4,863,000
Phosphoric acid (50% H_3PO_4)	89,630	67,717	497,322	437,907
Soda ash:				
Ammonia-soda process:				
Total wet and dry[2]	374,083	308,623	2,252,188	2,064,672
Finished light[3]	180,393	148,861	1,091,691	1,019,203
Finished dense	137,464	107,615	817,977	724,899
Natural[4]	22,173	16,937	128,310	99,843
Sodium bicarbonate, refined	14,147	13,355	95,771	92,499
Sodium bichromate and chromate	7,426	6,285	42,051	44,964
Sodium hydroxide:				
Electrolytic process:				
Liquid[5]	114,226	93,694	654,966	534,325
Solid	18,156	14,397	113,981	93,768
Lime soda process:				
Liquid[5]	61,670	55,047	338,623	362,880
Solid	20,640	14,043	121,895	105,340
Sodium phosphate:				
Monobasic (100% NaH_2PO_4)	1,291	677	7,169	5,625
Dibasic (100% Na_2HPO_4)	6,442	3,070	38,136	28,870
Tribasic (100% Na_3PO_4)	7,855	5,960	42,960	47,495
Meta (100% $NaPO_3$)	3,109	1,688	14,537	12,666
Tetra (100% $Na_4P_2O_7$)	5,096	3,341	25,542	26,833
Sodium silicate, anhydrous	32,814	35,020	240,812	191,350
Sodium sulphate:				
Anhydrous, refined	11,307	8,645	69,445	62,201
Glauber's salt[4]	15,582	13,567	103,138	82,418
Salt cake, crude, commercial[4]	54,361	44,633	811,017	261,423
Sulphuric acid:[7]				
Chamber process	258,307	224,243	1,677,048	1,501,625
Contact process, new	546,437	455,576	3,296,667	2,666,568

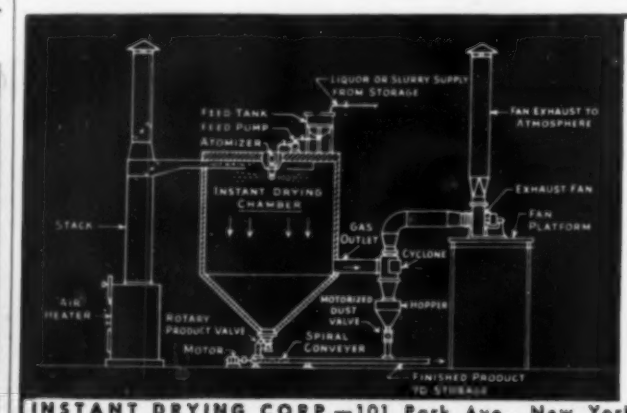
Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census. Production figures represent primary production and do not include purchased or transferred materials. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given data are either confidential or not yet available. [1]Includes a small amount of aqua ammonia. [2]Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finish light and finished dense. [3]Not including quantities converted to finish dense. [4]Data collected in cooperation with the Bureau of Mines. [5]Figures represent total production of liquid material, including quantities evaporated to solid caustic and reported as such. [6]Includes oleum grades, excludes spent acid. [7]Data for sulphuric acid manufactured as a byproduct of smelting operations are included. [8]Revised.

United States Production of Certain Synthetic Organic Chemicals

May 1947, May 1946 and Five-Month Totals for 1947 and 1946

Chemical	Total, Five Months 1947	Total, Five Months 1946	May 1947	May 1946
Acetanilid	3,384,197	2,890,029	690,278	474,208
Acetic Acid:				
Synthetic[1]	153,318,879	109,798,765	31,761,083	20,714,972
Recovered	608,860,682	478,529,252	128,376,120	95,293,469
Natural[2]	10,373,456	10,327,586	2,114,587	2,550,689
Acetic anhydride[3]	256,360,350	213,637,539	54,248,626	40,756,608
Acetone	150,169,276	133,024,846	31,777,958	26,046,575
Acetylsalicylic acid	4,876,125	4,885,328	1,052,519	975,168

(Continued on page 302)



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COMPRESSED AIR EXPLOSIONS

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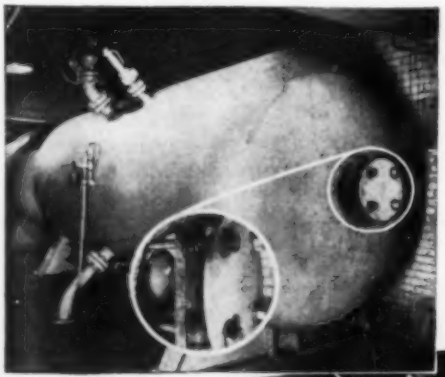
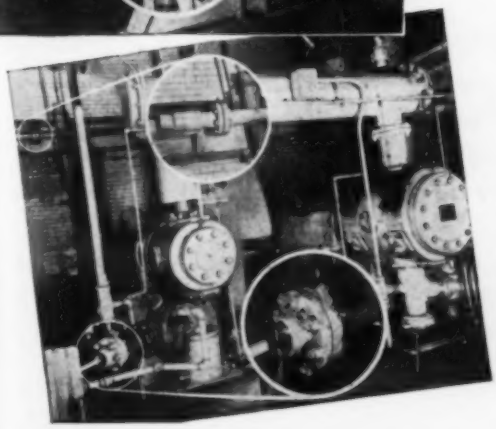
● Don't scoff . . . compressed air systems do explode! Insurance company records offer proof. Vaporized oil-air mixtures touched off by a fleck of hot carbon, leaky discharge valves allowing hot air to be drawn into the system, clogged intake filters overheating compressors . . . all these mean trouble. Inter and after coolers eliminate many dangers . . . relief valves handle normal pressure rises. But it takes SAFETY HEADS for that positive margin of safety. Yes, sir, SAFETY HEADS act instantly, even to high speed pressure waves! Provide full, pipe-size unrestricted relief opening.





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has been purifying a wide variety of lubricating, fuel, and industrial oils

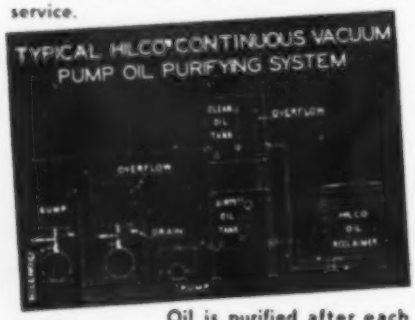
EQUIPMENT SERVICED BY HILCO in the Chemical Industry includes:

★ **VACUUM PUMPS**—lubricating and sealing oil maintained free from grit, sludge, acid, moisture and dissolved gases.

★ **COMPRESSORS** – kept free from carbon and varnish deposits.

★ **DIESEL ENGINES** – lube oil constantly kept in condition of new oil, greatly extending engine life; fuel oil filtered, promoting combustion efficiency.

★ **TRANSFORMERS** – insulating oil fully desludged, neutralized, dehydrated and deaerated without taking transformers out of service.



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THE HILLIARD Corporation
ELMIRA, N. Y.

PLEASE SEND YOUR BULLETIN NO. 95

NAME_____
COMPANY_____
STREET_____
CITY_____ STATE_____

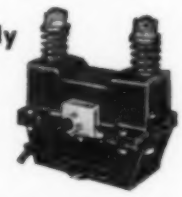
U. S. Production of Synthetic Organic Chemicals (Cont. from page 300)

Chemical	Total, Five Months 1947	Total, Five Months 1946	May 1947	May 1946
Aniline	45,320,674	34,428,842	9,377,617	6,721,261
Barbituric acid derivities:				
5-Ethyl-5-phenylbarbituric acid and salts (phenobarbital)	181,326	166,269	31,571	41,313
Benzene:				
Motor grade:				
Tar distillers[4]	2,093,667	4,668,216	695,067	782,756
Coke-oven operators	9,597,119	11,232,536	1,584,026	1,831,124
All other grades:				
Tar distillers[4]	9,093,245	10,040,066	2,042,247	2,451,310
Coke-oven operators[5]	61,320,133	35,169,996	12,380,492	5,019,921
Butyl alcohol primary, normal	51,176,033	42,677,893	14,475,015	8,586,333
Carbon bisulphide	243,468,990	120,569,035	29,732,310	22,941,851
Carbon tetrachloride	82,697,207	57,278,963	16,981,654	8,816,061
Chlorobenzene, mono	127,656,293	111,552,137	30,999,589	24,713,262
Creosote oil:				
Tar distillers[4]	54,511,423	46,711,388	10,170,720	3,554,030
Coke-oven operators[6]	15,528,890	8,790,703	3,283,735	964,830
Creosols, meta-para	2,290,327	1,931,860	508,738	204,589
Creosols, ortho-meta-para	4,056,416	.....	944,318	.....
Cresylic acid, refined [7,10]	11,102,178	8,387,222	2,196,359	1,361,784
Dibutyl phthalate	8,691,823	.....	1,056,490	1,091,150
Dichlorodiphenyltrichloroethane (DDT)	21,679,128	18,311,281	4,967,831	4,079,607
Ethyl acetate (85%)	37,243,121	35,373,038	6,088,211	7,179,862
Ethylene glycol	81,313,767	.....	18,530,506	.....
Ethyl ether	18,608,535	17,030,111	4,212,337	3,909,827
Formaldehyde (37% by wt.)	224,688,509	193,706,379	45,776,252	34,162,455
Hexachlorocyclohexane	1,331,721	.....	363,126	.....
Methanol, natural[9]	7,007,385	6,552,159	1,518,734	1,378,637
Methanol, synthetic	224,781,018	187,395,705	45,348,286	7,431,682
Naphthalene:				
Tar distillers, less than 79° C.	98,985,555	74,109,081	21,205,544	15,280,487
Tar distillers, 79° C. and over	52,220,561	41,354,610	8,685,899	7,889,395
Coke-oven operators, less than 79° C	37,394,256	21,045,883	7,265,148	2,152,410
Penicillin and salts[8]	13,842,578	10,320,720	2,446,583	2,678,000
Phenol	99,154,817	82,502,501	23,911,674	17,219,914
Phthalic anhydride	54,355,466	43,376,957	10,526,497	8,127,695
Styrene, government and private plants	139,145,161	149,134,634	26,716,416	33,557,386
Toluene:				
Coke-oven operators	10,916,214	6,738,647	2,009,789	1,280,479
All other[9]	12,524,823	5,148,138	1,602,261	959,057

All data in pounds except benzene (gal.) creosote oil (gal.), toluene (gal.) xylene (gal.) and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. [1]Excludes the statistics on recovered acid. [2]Acid produced by direct process from wood and from calcium acetate. [3]All acetic anhydride including that from acetic by vapor-phase process. [4]Product of distillers who use purchased coal tar only or from oil-gas or water-gas produced or purchased by tar distillers. [5]Statistics are given in terms of bulk medicinals only. [6]Statistics collected by Bureau of Mines. [7]Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. [8]Reported to U. S. Bureau of the Census. [9]Includes toluene produced from petroleum by any process. [10]Includes refined cresylic acid from petroleum.

Do Your Bins and Hoppers Show those "tattle-tale" Hammer and Sledge Marks?

If they do—then it's time to apply



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SYNTRON VIBRATORS eliminate these conditions—providing free-flowing bins and hoppers — and saving time and money.

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SYNTRON CO., 610 Lexington, Homer City, Pa.

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Strung out along every Bell System coaxial cable, electronic watchmen constantly mount guard over your voice. Some are in manholes under city streets; some are in little huts on the desert. Most situations they can deal with; if things threaten to get out of hand, they signal the nearest testboard.

Principal care of the electronic watchman is the transmission level. Sun-warmed cables use up more energy than cold ones, so a transcontinental call may take a millionfold more energy to carry it by day than by night. Each watchman — an electronic regulator — checks the transmission level and adjusts the amplification which sends your voice along to the next point. Many hundreds of regulators may be at work on a single long distance call.

Without automatic regulation, the precise control of energy in the Bell System's long distance circuits would be a superhuman task. So Bell Laboratories, which in 1913 developed the first high vacuum electronic amplifier, went on to devise the means to make them self-regulating in telephone systems. This is one reason why your long distance call goes through clearly, summer or winter.

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★ **A Practical High in Fractional Efficiencies**

★ **Most Work per Dollar in Overall Costs**

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Engineered Efficiency in **DUST RECOVERY**

CHEMICAL ENGINEERING Weighted Index of Prices for CHEMICALS

Base = 100 for 1937

As of September 1	123.41
Last month	122.17
September, 1946	111.36
September, 1945	108.63

CURRENT PRICES

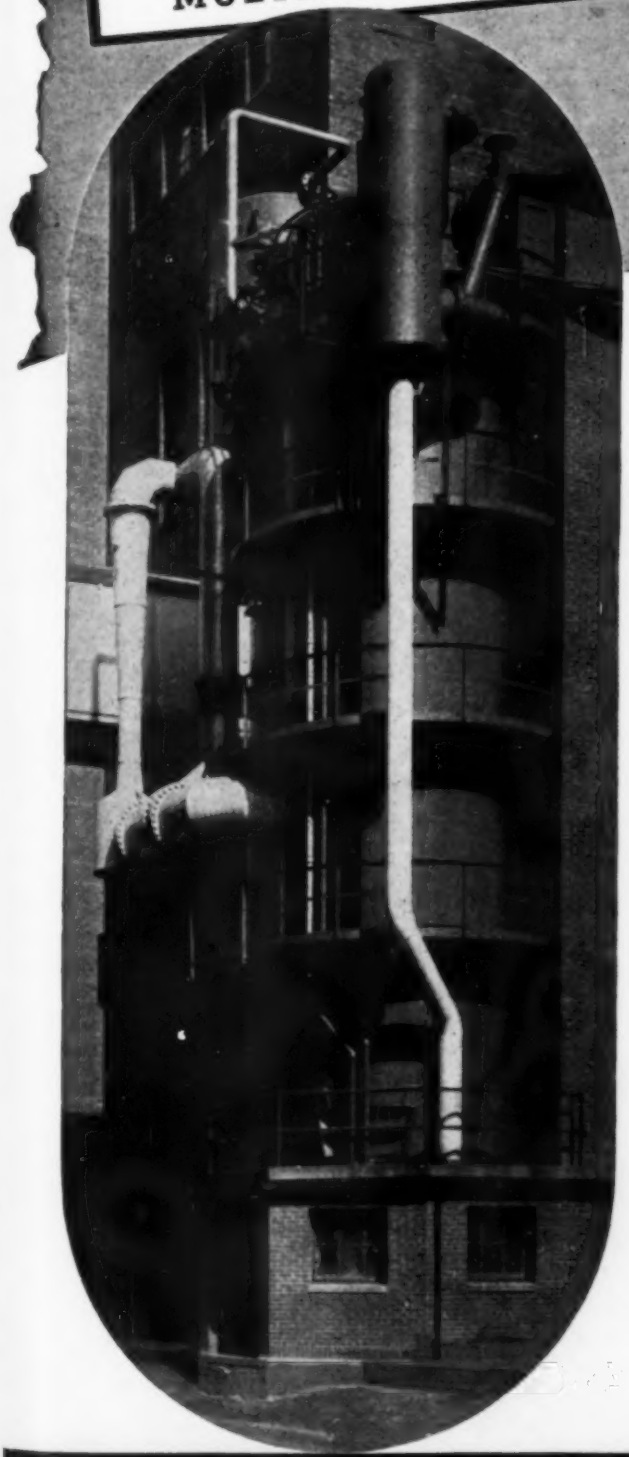
The accompanying prices refer to round lots; Where it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to September 1.

INDUSTRIAL CHEMICALS

Acetone, tank, lb	$0.07 - $0.09
Acid, acetic, 28%, bbl., 100 lb	3.78 - 4.03
Boric, bbl., ton	119.00 -123.00
Citric, drums, lb	.24½- .26
Formic, cbys., lb	.12 - .12½
Hydrofluoric, 30%, drums, lb	.08 - .085
Lactic, 44% tech., light, bbl., lb.	.0815- .0855
Muriatic 18%, tanks, 100 lb	1.00 -
Nitric, 36°, carboys, lb	.05 - .05½
Oleum, tanks, wks., ton	19.50 - 20.00
Oxalic, crystals, bbl., lb	.13 - .14
Phosphoric tech., tanks, lb	.0465-
Sulphuric, 60°, tanks, ton	13.00 -
Tartaric, powd., bbl., lb	.49½- .50
Alcohol, amyl from pentane, tanks, lb	.151-
Alcohol, butyl, tanks, lb	.14½- .29
Alcohol, ethyl, denatured, No. 1 special tanks, gal	.87 -
Alum, ammonia, lump, lb	.04¼-
Aluminum sulphate, com. bags, 100 lb	1.15 - 1.25
Ammonia, anhydrous, cyl., lb	.16 - .20
tanks, ton	59.00 - 61.50
Ammonium carbonate, powd., casks, lb	.09½- .10
Sulphate, wks., ton	30.00 - 35.00
Amyl acetate, tech. from pentane, tanks, lb	.21 -
Aqua ammonia, 26°, drums, lb	.03 - .03½
tanks, ton	65.00 -
Arsenic, white powd., bbl., lb	.06 - .07
Barium carbonate, bbl., ton	67.50 - 75.00
Chloride, bags, ton	85.00 - 90.00
Nitrate, casks, lb	.11½- .12
Blanc fixe, dry, bags, ton	67.50 - 72.50
Bleaching powder, f.o.b. wks., drums, 100 lb	2.75 - 3.00
Borax, gran., bags, ton	48.50 -
Calcium acetate, bags, 100 lb	3.00 -
Arsenate, dr., lb	.09½- .10
Carbide, drums, ton	50.00 -
Chloride, flake, bags, del., ton	21.50 - 38.00
Carbon bisulphide, drums, lb	.05 - .05½
Tetrachloride, drums, lb	.06½- .07
Chlorine, liquid, tanks, wks., 100 lb	2.00 - 2.30
Copperas, bgs., f.o.b., wks., ton	17.00 - 18.00
Copper carbonate, bbl., lb	.24 - .27
Sulphate, bags, 100 lb	7.60 - 7.75
Cream of tartar, bbl., lb	.41½- .42
Diethylene glycol, dr., lb	.14 - .15
Epsom salt, dom., tech., bbl., 100 lb	2.05 - 2.25
Ethyl acetate, tanks, lb	.09½- .10
Formaldehyde, 30%, dr., wks., lb.	.0545-
Furfural, tanks, lb	.09½-
Glaubers salt, bag, 100 lb	1.25 - 1.80
Glycerine, c.p., drums, extra, lb	.29½- .30
Lead: white, basic carbonate, dry casks, lb	.15½-
Red, dry, eck., lb	.18 -
Lead acetate, white crys., bbl., lb.	.19½- .20½
Arsenate, powd., bags, lb	.21½- .22
Lithopone, bags, lb	.06 - .06½
Magnesium carb., tech., bags, lb	.07½- .08
Methanol, 95%, tanks, gal	.60 -
Synthetic, tanks, gal	.24 - .29
Phosphorus, yellow, cases, lb	.22 - .25
Potassium bichromate, bags, lb	.10½- .10½
Chlorate, powd., lb	.09 - .09½
Hydroxide (c'stic potash) dr., lb	.07½- .09½
Muriate, 60%, bags, unit	.37½-
Nitrate, ref., bbl., lb	.08½- .21
Permanganate, drums, lb	.20½- .21½
Prussiate, yellow, casks, lb	.19 - .20
Sal ammoniac, white, casks, 100 lb	4.75 - 5.00
Salsoda, bbl., 100 lb	1.10 - 1.20
Salt cake, bulk, ton	20.00 -
Soda, ash, light, 58%, contract, bags, 100 lb	1.30 -
Dense, bags, 100 lb	1.38 -
Soda, caustic, 76% solid, drums, 100 lb	2.60 -
Acetate, del., lb	.05½- .06
Bicarbonate, bags, 100 lb	2.25 -
Bichromate, bags, lb	.08½- .09
Bisulphate, bulk, ton	20.00 - 24.00
Bisulphite, bbl., lb	.03 - .04

GUARDITE

MULTI-STAGE EVAPORATIVE COOLER



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There are no moving parts to wear. These units can be furnished in sizes to meet your requirements and fabricated of the proper materials to meet your conditions. When writing please state kind and quantity of material to be cooled and temperature range, amount and temperature of cooling water available, steam available and pressure.

We will be pleased to give complete information as to operation and costs.

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A FLARE FOR PROTECTION . . . Side wings on this metal-edged, easy-to-wear Protecto-Shield* give extra protection . . . deflects splashing liquids from face, head and eyes.

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FOR SPLASH-PROOF EYES . . . Rolled, resilient edges of this Over-All* rubber mask goggle hug facial contours to keep out chemical splash and metal spatter. Tops in comfort and protection.

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READING, PA. U.S.A.

223 WASHINGTON STREET, READING, PA., U.S.A.

CHEMICAL ENGINEERING Weighted Index of Prices for OILS & FATS

Base = 100 for 1937

As of September 1	260.79
Last month	222.93
September, 1946	152.23
September, 1945	145.63

Chlorate, kegs, lb	$0.06½ -	$0.06½
Cyanide, cases, dom., lb	.14½ -	.15
Fluoride, bbl., lb	.09½ -	.09½
Hyposulphite, bags, 100 lb	2.25 -	2.50
Metasilicate, bbl., 100 lb	3.40 -	4.00
Nitrate, bulk, ton	32.00 -	38.50
Nitrite, casks, lb	.06½ -	.07
Phosphate, tribasic, bags, 100 lb	3.50 -	
Prussiate, yel., bags, lb	.12 -	.12½
Silicate, 40°, dr., wks., 100 lb	.95 -	1.00
Sulphite, crys, bbl., lb	.02½ -	.02½
Sulphur, crude at mine, long ton	16.00 -	18.00
Dioxide, cyl., lb	.085-	.09
Dioxide, tanks, lb	.044-	
Tin crystals, bbl., lb	.55 -	
Zinc chloride, gran., bbl., lb	.07 -	.07½
Oxide, lead free, bags, lb	.10 -	.10½
Oxide, 35%, leaded, bags, lb	.11½ -	.12
Sulphate, bags, cwt	4.15 -	7.00

OILS AND FATS

Castor oil, No. 3 dr., lb	$0.26½ -	
Chinawood, oil, tanks, lb	.2 -	
Coconut oil, ceylon, N. Y., lb	.13 -	
Corn oil, crude, tanks, (f.o.b. mill), lb	.18 -	
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.16½ -	
Linseed oil, raw, car lots, dr., lb	.29 -	
Palm, casks, lb	nom.	
Peanut oil, crude, tanks (mill), lb.	.17½ -	
Rapeseed oil, refined, bbl., lb	nom.	
Soybean, tanks, lb	.15½ -	
Menhaden, light, pressed dr., lb	.18 -	
Crude, tanks (f.o.b. factory), lb.	.10.	
Grease, yellow, loose, lb	.11½ -	
Oleo stearine, lb	nom.	
Oleo oil, No. 1, lb	.18 -	
Red oil, distilled, bbl., lb	.17½ -	
Tallow, extra, loose, lb	.12½	

COAL TAR PRODUCTS

Alpha-naphthol, crude, bbl., lb	$0.58 -	$0.60
Alpha-naphthylamine, bbl., lb	.35 -	.36
Aniline oil, drums, lb	.13 -	.13½
Aniline salts, bbl., lb	.22 -	.24
Benzaldehyde, tech., dr., lb	.45 -	.50
Benzidine base, bbl., lb	.75 -	.77
Benzoic acid, USP, kegs, lb	.54 -	.56
Benzol, 90% tanks, works, gal	.19 -	
Benzyl chloride, tech., dr., lb	.20 -	.21
Beta, naphthol, tech., drums, lb	.23 -	.24
Cresol, USP, dr., lb	.13½ -	
Cresylic acid, dr., wks., gal	1.00 -	1.05
Diphenyl, bbl., lb	.16 -	
Diethylaniline, dr., lb	.48 -	.50
Dinitrotoluol, bbl., lb	.18 -	.19
Dinitrophenyl, bbl., lb	.22 -	.23
Dip oil, 15%, dr., gal	.23 -	.25
Diphenylamine, dr., f.o.b. wks., lb	.25 -	
H acid, bbl., lb	.50 -	.52
Hydroquinone, bbl., lb	.90 -	.95
Naphthalene, flake, bbl., lb	.11 -	.11½
Nitrobenzene, dr., lb	.08½ -	.09
Para-Cresol, bbl., lb	.41 -	
Para-nitroaniline, bbl., lb	.42 -	.43
Phenol, USP, tanks, lb	.10½ -	.11
Picric, acid, bbl., lb	.30 -	.32
Pyridine, dr., gal	1.55 -	1.60
Resorcinol, tech., kegs, lb	.68 -	.70
Salicylic acid, tech., bbl., lb	.26 -	.27
Solvent naphtha, w.w., tanks, gal.	.25 -	
Toluidin, bbl., lb	1.00 -	
Toluol, drums, works, gal	.23 -	
Xylol, com., tanks, gal	.25 -	

MISCELLANEOUS

Casein, tech., bbl., lb	$.32 -	$.35
Dry colors:		
Carbon gas, black (wks.), lb	.04 -	.07
Prussian blue, bbl., lb	.42 -	.43
Ultramarine blue, bbl., lb	.13 -	.24
Chrome green, bbl., lb	.31 -	.40
Carmine red, tins, lb	5.50 -	6.00
Para toner, lb	.80 -	.95
Vermilion, English, bbl., lb	2.50 -	2.70
Chrome yellow, C. P., bbl., lb	.26 -	.28
Gum copal, Congo bags, lb	.09 -	.55
Manila, bags, lb	.09 -	.15
Damar, Batavia, cases, lb	.10 -	.22
Kauri, cases, lb	.18 -	.60
Magnesite, calc., ton	60.00 -	
Pumice stone, lump, bbl., lb	.05 -	.07
Rosin, H., 100 lb	8.10 -	
Shellac, orange, fine, bags, lb	.55 -	.57
Bleached, bonedry, bags, lb	.58 -	.60
T. N. bags, lb	.54 -	.55
Turpentine, gal	.70 -	

Nickel shipping drums have these 5 advantages

Drums manufactured by Niles Steel Products: Division Republic Steel Corp., Niles, Ohio

1 I.C.C. ACCEPTANCE

Built to I.C.C. Specification 5K, the nickel shipping drum pictured here is used for safe, efficient handling and shipping of phosphorus oxychloride and phosphorus trichloride.

2 LIGHT WEIGHT

Tare weight of an average 55-gallon nickel drum is less than 125 pounds. Nickel drums are not only easier to handle, but they also enable you to save on freight charges.

3 CORROSION RESISTANCE

Nickel's high resistance to corrosion keeps metal pick-up low, and helps maintain product purity. That's why Nickel is so widely used in the production, handling and transportation of phosphorus compounds, caustic soda, caustic potash, phenol and other chemicals.

4 STRENGTH AND WORKING QUALITIES

In addition to corrosion resistance, nickel possesses great mechanical strength and toughness. However, this does not mean that it is hard to fabricate. Nickel is readily bent, forged and machined. It may be welded, brazed and soldered by commonly used methods.

5 LONG LIFE

One company reports using the same nickel drums for handling phosphorus compounds since 1937. This is not unusual, for Nickel's unique combination of strength, toughness, corrosion resistance, hardness and ductility assures long equipment life . . . and minimum maintenance expense.

INCO Nickel

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street, New York 5, N. Y.

NEW CONSTRUCTION

	Current Projects		Cumulative 1947	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	.....	$8,961,000	$2,431,000
Middle Atlantic	$150,000	$1,556,000	6,992,000	21,386,000
South	220,000	153,000	11,581,000	41,268,000
Middle West	144,000	205,000	16,592,000	16,558,000
West of Mississippi	6,890,000	4,253,000	238,302,000	95,196,000
Far West	.....	.....	4,206,000	12,156,000
Canada	.....	1,025,000	51,846,000	1,025,000
Total	$7,404,000	$7,192,000	$338,480,000	$190,020,000

Proposed Work

Ariz., Phoenix—El Paso Natural Gas Co., El Paso, Tex., plans to construct a 10,000 hp. compressor station. Estimated cost $400,000.

Ind., Mecca—Clay Pipe Co., Rockville, Ind., plans to construct a 3 story, 48x65 ft. factory. Harry Ray May, Cadiz Pike, R. R. 1, Martins Ferry, O., Archt. Estimated cost $55,000.

Ky., London—Knoxville Fertilizer Co., Marysville Pike, Nashville, plans to construct a fertilizer plant. Estimated cost $150,000.

Mich., Kalamazoo—Allied Paper Mills, Kalamazoo, plans to construct an addition to its paper mill. Estimated cost $88,725.

Miss., Liberty—Interstate Oil Pipe Line Co., P. O. Box 1349, Tulsa, Okla., plans to double the capacity of its pumping station. Estimated cost $70,000.

Mo., St. Louis—Pittsburgh Plate Glass Co., 1106 Central Industrial Dr., plans to construct a 1 story distribution warehouse, office and sales building. A. Stanley Knorth & Associates, 4875 Easton Ave., Archt. Estimated cost $400,000.

New Mexico—El Paso Natural Gas Co., El Paso, Tex., plans to construct two compressor stations near Eunice and one each at Fullerton, Jal and Lordsburg. Estimated cost $550,000, $400,000, $300,000, $80,000 and $450,000 respectively.

N. Y., Niagara Falls—Oldbury Electro Chemical Co., Buffalo Ave., plans to construct three furnace buildings. Estimated cost $150,000.

Tex., Beeville—Western Natural Gas Co., Chronicle Bldg., Houston, plans to construct a recycling plant. Estimated cost $750,000.

Tex., Dallas—Texas Pipe Line Co., Texas Bldg., Houston, plans to construct a pipe line terminal here. Estimated cost $275,000.

Tex., Dumas—El Paso Natural Gas Co., El Paso, plans to construct a 20,000 hp. compressor station. Estimated cost $1,200,000.

Tex., El Paso—El Paso Natural Gas Co., El Paso, plans to construct a 12,000 hp. compressor station. Estimated cost $450,000.

Tex., Houston—Eastern States Petroleum Co., Manchester Townsite, plans to modernize, improve and enlarge its gasoline plant. Estimated cost $550,000.

Tex., Houston—Texas Pipe Line Co., Texas Bldg., plans to construct a pipe line terminal here. Estimated cost $300,000.

Tex., Pine Springs—El Paso Natural Gas Co., El Paso, plans to construct a 12,000 hp. compressor station. Estimated cost $450,000.

Tex., Portland—Louis Wohinc, c/o Plymouth Oil Co., Portland, plans to construct a glass manufacturing plant. Estimated cost $275,000.

Tex., San Antonio—Valcar Enterprise, Inc., P. O. Box 5021, Dallas, plans to construct a solvent extraction plant. Estimated cost $60,000.

Contracts Awarded

Ark., Arkansas City—Kantoex Refining Co., Arkansas City, has awarded the contract for modernizing its refinery to Koch Engineering Co., Arkansas City. Estimated cost $275,000.

Ga., Atlanta—Sherwin Williams Co., c/o Robert & Co., Archts., Bona Allen Bldg., has awarded the contract for a paint storage warehouse to Van Winkle & Co., Whitehead Bldg. Estimated cost $98,000.

Ill., Monsanto—Monsanto Chemical Co., 1700 South Second St., St. Louis, has awarded the contract for superstructure for power house extension, addition to office building, 2 story, 60x165 ft. warehouse and 2 story, 55x67 ft. laboratory extension, to William H. & Nelson Cunliff Co., 3320 Lindell Blvd., St. Louis.

Minn., Minneapolis—Spencer Kellogg & Sons, 1054 Grain Exchange Annex, has awarded the contract for a linseed oil storage building, including warehouse and steel tanks, to H. H. Stahr Co., 239 Foshay Tower, Minneapolis. Estimated cost $112,000.

Mo., St. Louis—Atlas Enameling Co., Inc., 2020 North Broadway, has awarded the contract for a factory building to Bumiller & Meyersieck, 2604 Cherokee St., St. Louis. Estimated cost $70,000.

N. J., Eagle Point—Texas Co., 135 East 42nd St., New York, N. Y., has awarded the contract for a 52,000 bbl. a day distillation unit to Foster-Wheeler Corp., 165 Bway., New York, N. Y.; a fluid catalytic cracking unit to M. W. Kellogg Co., 225 Bway, New York, N. Y.

N. Y., Niagara Falls—Carborundum Co., Niagara Falls, has awarded the contract for a maintenance building to Turner Construction Co., 420 Lexington Ave., New York, N. Y. Estimated cost $1,000,000.

O., Cincinnati—National Cylinder Gas Co., 4620 Este Ave., has awarded the contract for an addition to its plant to H. K. Ferguson Co., Peoples Bank Bldg., Cincinnati. Estimated cost $150,000.

Okla., Duncan—Skelly Oil Co., Box 1650, Tulsa, has awarded the contract for a natural gasoline plapt to Born Engineering Co., 404 North Boston St., Tulsa. Estimated cost $960,000.

Pa., Floreffe—Mississippi Glass Co., Floreffe, will construct 1 story, 43x300 ft. loading platforms. Work will be done by separate contracts. Estimated cost $56,000.

Tex., Dallas—The American Optical Co., 1711 Commerce St., has awarded the contract for an optical plant and warehouse to Barry Construction Co., Dallas. Estimated cost $175,000.

Tex., Kountze—Pan American Production Co., M. Esperson Bldg., Houston, has awarded the contract for a pressure maintenance plant to O. L. Olsen Co., Esperson Bldg., Houston. Estimated cost $200,000.

Tex., Port Arthur—Gulf Refining Co., Port Arthur, has awarded the contract for refinery improvements and six chimneys to Rust Engineering Co., 280 Clroiss St., Pittsburgh, Pa. Estimated cost $126,000.

Tex., Stinnett—Texoma Natural Gas Co., 20 North Wacker Dr., Chicago, Ill., has awarded the contract for additional gas booster station units to Midwestern Contractors, Inc., 105 North Boulder St., Tulsa, Okla. Estimated cost $480,000.

Tex., Winnie—McCarthy Chemical Co., Sterling Bldg., Houston, has awarded the contract for a chemical plant and foundation for plant machinery and equipment to Tellepson Construction Co., 3900 Clay St., Houston. Estimated cost $1,650,000 and $150,000 respectively.

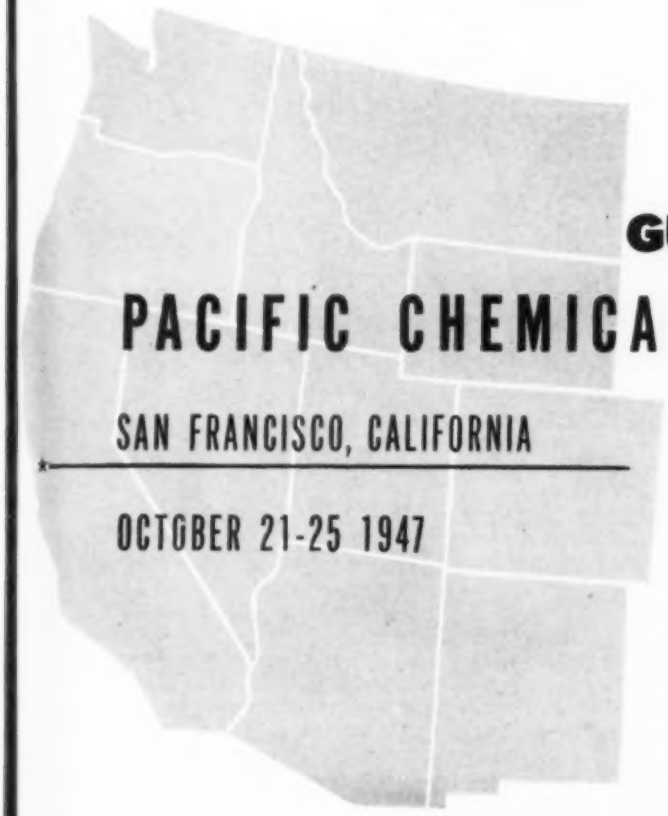
W. Va., Clarksburg—Rolland Glass Co., Clarksburg, has awarded the contract for a 60x75 ft. addition to its factory to Baker & Coombs, 319 Domain Ave., Morgantown. Estimated cost $55,000.

Wis., Marinette—Ansul Chemical Co., Marinette, has awarded the contract for a 1 story 80x106 ft. sulphur dioxide plant and 1 story, 70x240 ft. factory addition to Erling Arntzen, c/o Owner.

Ont., Sarnia—Fiberglas Canada, Ltd., Oshawa, Ont., has awarded the contract for a group of factory buildings to R. W. McKay, Sarnia. Estimated cost $500,000.

Que., Beaupre—Distillerie Montmorency, Inc., 30 First Ave., has awarded the contract for a 2 story distillery building to Foundation Co. of Canada, Ltd., 1900 Sherbrooke St., W., Montreal. Estimated cost $225,000.

Que., Ville La Salle—Howard Smith Paper Mills, Ltd., 407 McGill St., Montreal, has awarded the contract for a factory building to Byers Construction Co., Ltd., 5675 Western Ave., Montreal. Estimated cost $300,000.

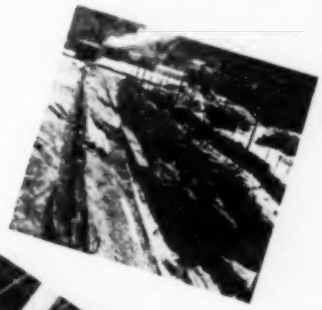


GUIDE AND DIRECTORY

PACIFIC CHEMICAL EXPOSITION

SAN FRANCISCO, CALIFORNIA

OCTOBER 21-25 1947



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★ EXHIBITORS ★

A

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AMERICAN CHEMICAL SOCIETY, 1155 Sixteenth Street, N. W., Washington 6, D. C. Host: Walter J. Murphy 109

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AMERICAN RESINOUS CHEMICALS CORP., South Myrtle Avenue, Post Office Box 97, Monrovia, California. Host: Ashworth N. Stull 22

ARMOUR AND COMPANY, 1425 West 42nd Street, Chicago 9, Illinois. Host: A. B. Rogers 100

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ATLAS POWDER CO., Wilmington 99, Delaware, Host: John Swenehart 69

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AUTOCLAVE ENGINEERS, INC., 3737 West Cortland Street, Chicago 47, Illinois. Host: John H. Schultheis 27

B

BAGPAK DIVISION, INTERNATIONAL PAPER CO., 220 East 42nd Street, New York City 17. Host: R. W. Worthington 30

BARCO MANUFACTURING CO., Not Inc., 1801 West Winnemac Avenue, Chicago 40, Illinois. Host: H. S. Kuhn 105

BARECO OIL COMPANY, Post Office Box 2009, Tulsa 2, Oklahoma. Host: Bruce H. Clary 49

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CESCO INC., 593 Market Street, San Francisco 5, California. Host: D. E. Stem 4

CHEMCO, 1700 North Main Street, Los Angeles 54, California. Host: E. B. Horton 66

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CHEMICAL AND ENGINEERING NEWS, 1155 Sixteenth Street, N. W., Washington 6, D. C. Host: Walter J. Murphy 109

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CHEMICAL PROCESS COMPANY, 901 Spring Street, Redwood City, California. Host: Dr. B. N. Dickinson 48

COLUMBIA ENGINEERING SERVICE COMPANY, 593 Market Street, San Francisco 5, California. Host: D. E. Stem 4

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E

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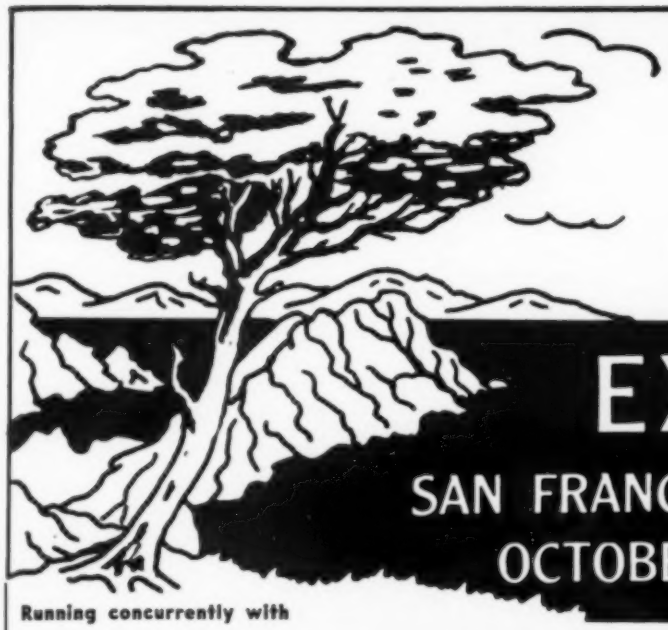

PLAN TO ATTEND PACIFIC CHEMICAL EXPOSITION

SAN FRANCISCO CIVIC AUDITORIUM

OCTOBER 21ST TO 25TH INC. 1947

Running concurrently with

THE PACIFIC INDUSTRIAL CONFERENCES

PARTICIPATING ORGANIZATIONS:

American Institute of Chemical Engineers (California Section)
American Inst. of Mining and Metallurgical Engineers
Analytical Group, ACS, (California Section)
Golden Gate Paint and Varnish Club
Institute of Food Technologists (No. & So. Calif. Section)
Los Angeles Rubber Group
Northern California Rubber Group
Pacific Insecticide Institute
Petroleum Section ACS (California Section)
San Francisco Chamber of Commerce
Western Chemical Market Research Group

SPEAKERS INCLUDE TOP MEN IN EACH FIELD

Complete Program May Be Obtained by Writing to Address Below.

CONTINUOUS PROGRAMS OF FINEST INDUSTRIAL MOVIES

The Movie Committee of the California Section of the American Chemical Society, headed by Dr. Richard Wistar, has selected a group of the finest Industrial Movies available in America to run as a continuous program during the Exposition.

SPECIAL EXHIBITS

ATOMIC CHEMISTRY and how it may affect industry, will be featured in a special exhibit of the American Chemical Society, prepared under the personal supervision of its editor, Walter J. Murphy.

U. S. GEOLOGICAL SURVEY will present an Eleven-Western-States Natural Resources exhibit, with disclosures of many finds made during the war.

NEW CHEMICALS FOR INDUSTRY is a display of hundreds of samples, together with individual data on each, assembled under the supervision of Robert Taylor, editor of Chemical Industries.

WESTERN REGIONAL RESEARCH LABORATORY of the U. S. Department of Agriculture, will have some significant exhibits resulting from work of all four Regional Laboratories.

NATIONAL BUREAU OF STANDARDS is providing a display revealing important work on hydrocarbons done under the supervision of Dr. Frederick D. Rissini.

Everyone concerned with chemicals or chemists is urged to attend.

Admission free, but by registration

COMMERCIAL EXHIBITS*

Commercial exhibits are the very heart of the Pacific Chemical Exposition. They are of great educational value. They are installed and manned by the following companies:

AAA Manufacturing Company
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Amecco Chemicals, Inc.
American Chemical Society
American Cyanamid Company
American Hard Rubber Company
American Heat Reclaiming Corporation
American Potash & Chemical Corporation
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* As of 8-19-47

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MERIAM INSTRUMENT CO., Cleveland 2, Ohio. Host: Charles Meriam 6

MONTGOMERY BROTHERS, 1122 Howard Street, San Francisco 3, California. Host: E. W. Sherburne 67

N

NATIONAL ENGINEERING COMPANY, 549 West Washington Boulevard, Chicago 6, Illinois. Host: Otto H. Rosentreter 82

NATIONAL PERLITE COMPANY, Campbell, California. Host: Richard Buckles 5

NATIONAL TECHNICAL LABORATORIES, 820 Mission Street, South Pasadena, California. Host: Thos. F. Herring 55a

NEW ENGLAND TANK & TOWER COMPANY, Everett, Massachusetts. Host: Douglas R. Stiehl 2–3

NEW JERSEY MACHINE CORP., Willow Avenue at 16th Street, Hoboken, New Jersey. Host: Peter L. Heguy 26

NIAGARA FILTER CORP., 3080 Main Street, Buffalo 14, New York. Host: C. T. White 99

NURNBERG THERMOMETER CO., INC., 5709 Grove Street, Oakland, California. Host: J. R. Hutchison.. 95

O

ORONITE CHEMICAL COMPANY, 225 Bush Street, Room 1409, San Francisco 20, California 40, 51

ORVILLE SIMPSON COMPANY, 1230 Knowlton Street, Cincinnati 23, Ohio. Host: Douglas R. Stiehl 2–3

P

THE PACIFIC LUMBER COMPANY, 100 Bush Street, San Francisco 4, California. Host: Edric E. Brown.. 78

PATTERSON FOUNDRY & MACHINE CO., East Liverpool, Ohio. Host: Harry M. Brown, S. M. 89

PERFECTING SERVICE COMPANY, 6140 Cottage Grove Avenue, Chicago 37, Illinois. Host: B. O. Bushnell 98

PERFEKTUM PRODUCTS CO., 300 Fourth Avenue, New York City 10 12–13

LEONARD PETERSON & COMPANY, INC., 1222 West Fullerton Avenue, Chicago 14, Ill 9

PFAUDLER SALES CO., 1325 Howard Street, San Francisco 3, California. Host: J. E. Simpson 7

PHILADELPHIA QUARTZ CO. OF CALIF., Sixth and Grayson Streets, Berkeley 2, California. Host: Glenn Johnson 101

PITTSBURGH *LECTRODRYER* CORPORATION, Box 1766, Pittsburgh 30, Pennsylvania. Host: Douglas R. Stiehl 2–3

POPPER & KLEIN, INC., 300 Fourth Avenue, New York City 10 12–13

PRECISION SCIENTIFIC CO., 3737 West Cortland Street, Chicago 47, Illinois. Host: John H. Schultheis 27

PROCESS EQUIPMENT CORPORATION, 307 North Michigan Avenue, Chicago 1, Illinois. Host: P. B. Carter, Jr. 61

R

REDMAN SCIENTIFIC COMPANY, 585 Howard Street, San Francisco 5, California. Host: Donald W. Baldra 8

REICHHOLD CHEMICALS, INC., 601 Woodward Heights Boulevard, Detroit 20, Michigan. Host: W. R. Barrett 23–24–25

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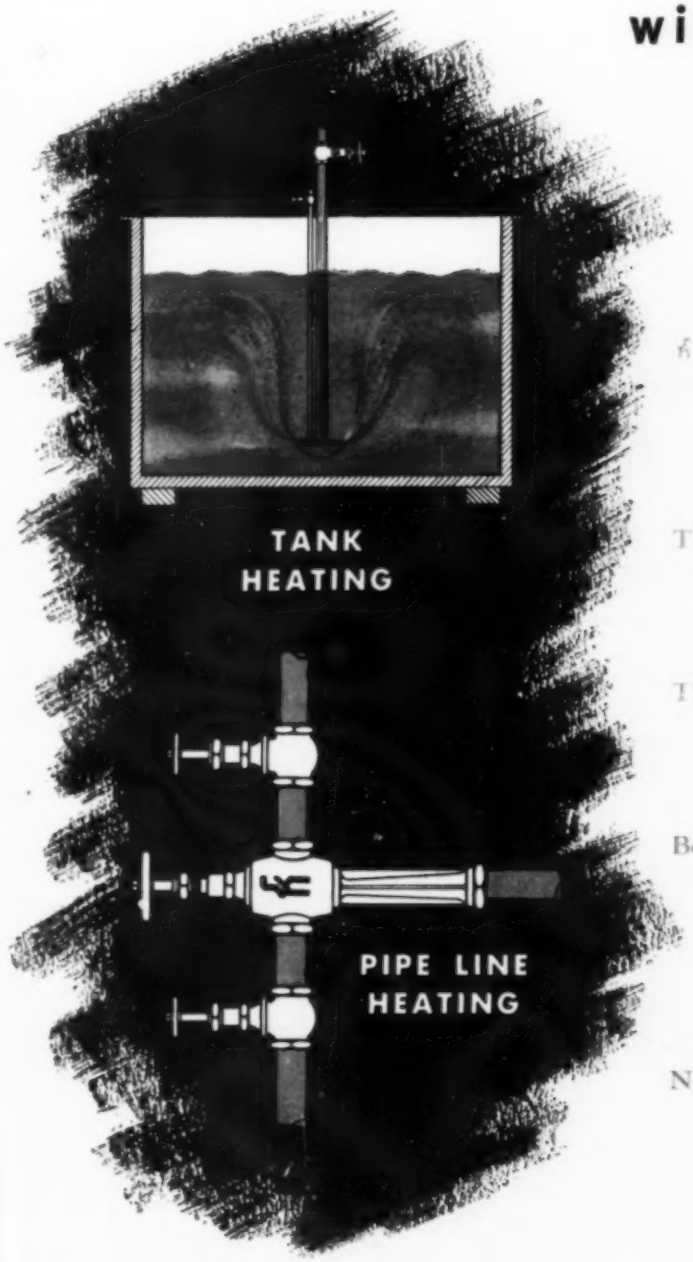
Index As Supplied by the Exposition Management

PACIFIC CHEMICAL EXPOSITION—1947

an ƒk "reason why"

heats economically

without noise



ƒk Steam Jet Heaters . . .

Mix steam with cold liquids . . .
For uniform heating . . .
Without noise.

They have no rotating parts . . .

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Adjust or repair.

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Economically . . .
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Schutte and Koerting have always quoted "Firm Prices"—a principle in good business, for all business.

★ EXHIBITORS ★

MILTON ROY COMPANY, 1300 East Mermaid Avenue, Philadelphia 18, Pennsylvania. Host: Robert T. Sheen 85

S

SARCO COMPANY, INC., 475 Fifth Avenue, New York City 17 47

CLAUDE B. SCHNEIBLE COMPANY, Post Office Box 502, Roosevelt Annex, Detroit 32, Michigan. Host: L. Carl Beers 80

SCHUTTE & KOERTING CO., Philadelphia 22, Pennsylvania. Host: G. M. Cooke 6

SCIENTIFIC SUPPLIES CORP., 122 Jackson St., Seattle, Washington 39

SCOTT ELECTROFLUX COMPANY, 400 Main Street, Waltham, Massachusetts 42

E. H. SHELDON & CO., 720 Vims Street, Muskegon, Michigan 104

SHELL CHEMICAL CORPORATION, 100 Bush Street, San Francisco 6, California. Host: S. S. Lawrence .. 73–74

SHELL OIL COMPANY, INCORPORATED, 100 Bush Street, San Francisco 6, California. Host: S. S. Lawrence 73–74

SPARKLER MANUFACTURING COMPANY, Mundelein, Illinois. Host: Kenneth L. Carr 108

STANDARD OIL COMPANY OF CALIFORNIA, 225 Bush Street, Room 1409, San Francisco 20, California 40, 51

STAUFFER CHEMICAL CO., 636 California Street, San Francisco 8, California. Host: W. H. Oliver 62

STEDMAN'S FOUNDRY & MACHINE WORKS, Aurora, Indiana. Host: Douglas R. Stiehl 2, 3

SUPERIOR ELECTRIC COMPANY, 83 Laurel Street, Bristol, Connecticut 102

TRACERLAB, INC., 55 Oliver Street, Boston 10, Massachusetts. Host: Walton A. Wickett 38

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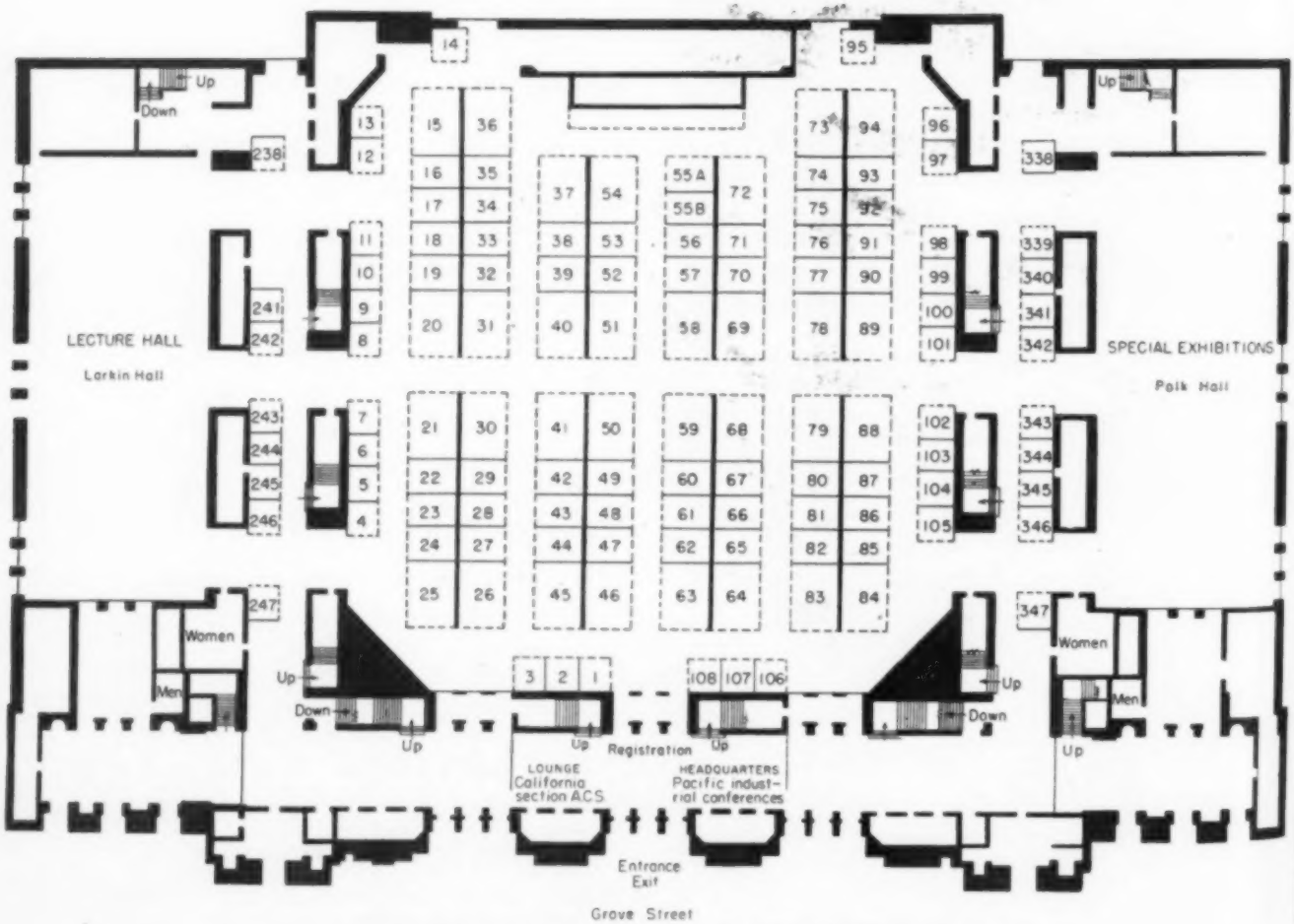
U. S. INDUSTRIAL CHEMICALS, INC., 60 East 42nd Street, New York City 17. Host: R. E. Alexander .. 64

W

THE WATSON-STILLMAN CO., Roselle, New Jersey. Host: Walter L. Duhig 29

★ FLOOR PLAN ★



Index As Supplied by the Exposition Management

PACIFIC CHEMICAL EXPOSITION—1947

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Tough, siftproof, will withstand rough handling. Quality controlled throughout all manufacturing operations.

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Tear-resistant, puncture-resistant, siftproof, moistureproof. Ideal for chemicals needing extra protection.

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Charlotte • Denver • Detroit
East Pepperell • Houston
Indianapolis • Kansas City
Jacksonville, Fla. • Memphis
St. Helens, Ore. • St. Louis • Salt Lake City • San Francisco • Seattle • Wichita
Wilmington, California

Los Angeles • Louisville
Minneapolis • New Orleans
Mobile • New York City
Norfolk • Oklahoma City
Orlando • Omaha • Peoria
Phoenix • Pittsburgh • Salina

EXHIBITORS

CLASSIFIED BY PRODUCTS

ABRASIVES
National Perlite Company. (5)
Nurnberg Thermometer Co., Inc. (95)

ABSORBERS
G. M. Cooke Factory Representative (6)
Ertel Engineering Corporation (60)
Nurnberg Thermometer Co., Inc. (95)
Patterson Foundry & Machine Co. (89)
Claude B. Schneible Company (80)
Schutte & Koerting Co. (6)

ACID HANDLING EQUIPMENT
American Hard Rubber Co. (66)
A. B. Boyd Co. (66)
L. H. Butcher Co. (41)
Chemco (66)
Chemical Equipment Co. (66)
G. M. Cooke Factory Representative (6)
The Duriron Company, Inc. (2-3)
Fernholtz Machinery Company (10)
Jabsco Pump Co. (11)
The Jack-Stiehl Company (2-3)
Niagara Filter Corp. (99)
Nurnberg Thermometer Co., Inc. (95)
Redman Scientific Company (8)
Claude B. Schneible Company (80)
Schutte & Koerting Co. (6)

ACID RESISTING MATERIALS
Alberene Stone Corporation of Virginia (2-3)
American Hard Rubber Co. (66)
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Reichhold Chemicals, Inc. (23-24-25)

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Commercial Solvents Corporation (31)
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Shell Chemical Corporation (73-74)
Shell Oil Company, Incorporated (73-74)

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Pfaudler Sales Co. (7)

ALLOYS, Non-Ferrous
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AMINES
Armour and Company, Chemical Research & Development Dept. (100)
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General Petroleum Corporation (45)

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CARBON—Tubing and Shapes

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Cooper Alloy Foundry Co. (28)
The Dow Chemical Company (55b-56-57-58)
Walter L. Duhig (28-29)
Electric Steel Foundry Company (93-94)
Fernholtz Machinery Company (10)

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American Resinous Chemicals Corp. (22)
The Dow Chemical Company (55b-56-57-58)

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Atlas Mineral Products Company (2-3)
Patterson Foundry & Machine Co. (89)

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Nurnberg Thermometer Co., Inc. (95)

CERAMIC AND PORCELAIN EQUIPMENT, Industrial
L. H. Butcher Co. (41)
Eriez Manufacturing Company (59)
Fernholtz Machinery Company (10)
Fischer & Porter Company (96)
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Patterson Foundry & Machine Co. (89)

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A. B. Boyd Co. (66)
L. H. Butcher Co. (41)
Chemco (66)
Chemical Equipment Co. (66)
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General Petroleum Corporation (45)

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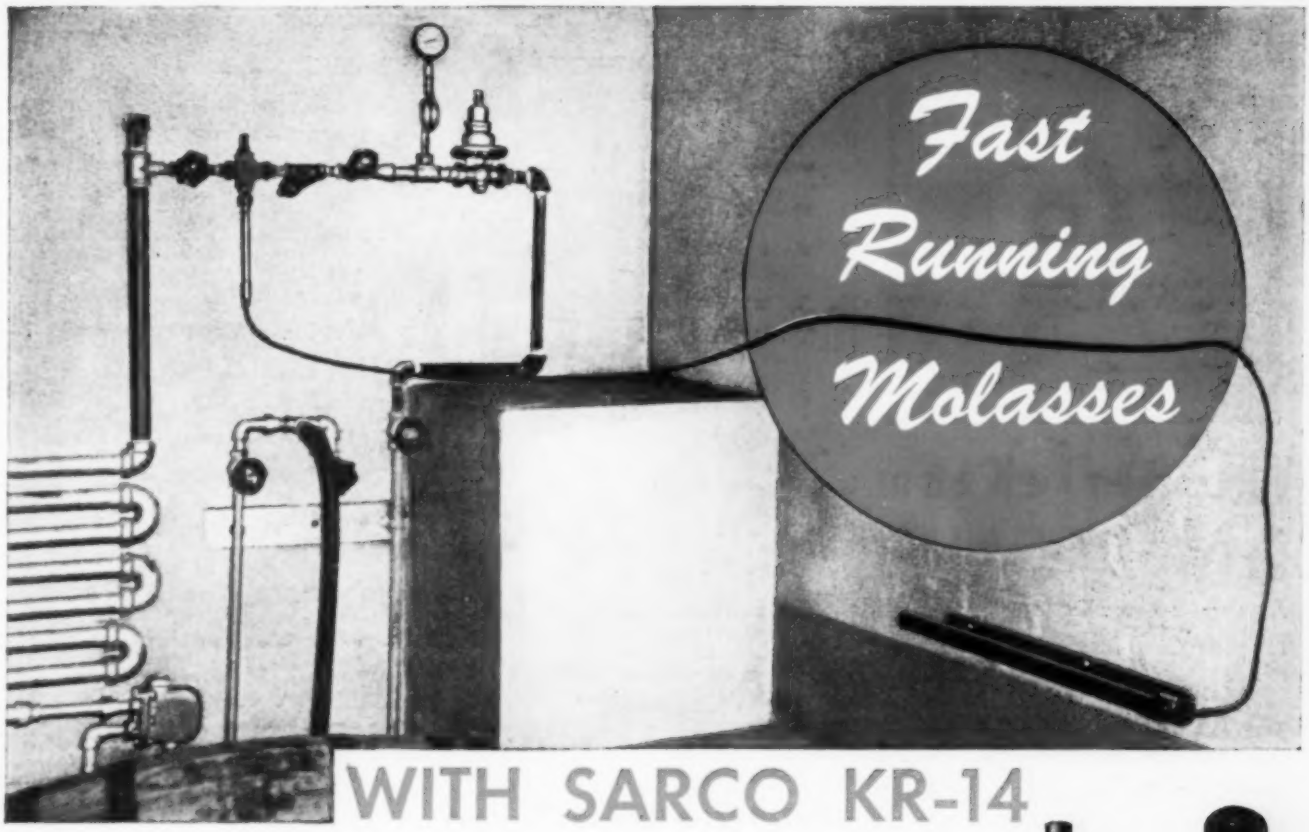

WITH SARCO KR-14 TEMPERATURE CONTROL

January or June, molasses runs freely—at exact temperatures from the main storage tank in this large food plant in Buffalo. The entire room, including incoming barrels of molasses, is heated by steam coils controlled by the Sarco KR-14 room temperature control. The coils are drained by Sarco float thermostatic steam traps.

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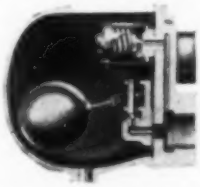

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Properly selected and installed together with suitable Sarco Steam Traps, you will also benefit by a reduction in the cost of fuel wherever steam or hot water is used.

The nearest Sarco Representative will help you select the best combination for your plant.

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Cooper Alloy Foundry Co. (28)
Walter L. Duhig (28-29)
The Duriron Company, Inc. (2-3)
Electric Steel Foundry Company (93-94)
Ertel Engineering Corporation (60)
Fernholtz Machinery Company (10)
Fischer & Porter Company (96)
The Fluor Corporation, Ltd. (37)
The Jack-Stiehl Company (2-3)
Leslie Co. (43)
Niagara Filter Corp. (99)
Patterson Foundry & Machine Co. (89)
Pfaudler Sales Co. (7)
Claude B. Schneible Company (80)
Schutte & Koerting Co. (6)
The Watson-Stillman Co. (29)

CHEMICAL RESEARCH
Fischer & Porter Company (96)

CHEMICALS, Food
American Cyanamid Company (71-72)
Commercial Solvents Corporation (31)
The Dow Chemical Company (55b-56-57-58)
General Chemical Company (32-33)
Glyco Products Co., Inc. (54)
Stauffer Chemical Co. (62)
U. S. Industrial Chemicals, Inc. (64)

CHEMICALS, Industrial-Inorganic
American Cyanamid Company (71-72)
L. H. Butcher Co. (41)
Commercial Solvents Corporation (31)
The Dow Chemical Company (55b-56-57-58)
General Chemical Company (32-33)
A. R. Maas Chemical Co. (77)
Philadelphia Quartz Co. of Calif. (101)
Stauffer Chemical Co. (62)

CHEMICALS, Industrial-Organic
Amecco Chemicals, Inc. (75)
American Cyanamid Company (71-72)
L. H. Butcher Co. (41)
Commercial Solvents Corporation (31)
The Dow Chemical Company (55b-56-57-58)
General Chemical Company (32-33)
Glyco Products Co., Inc. (54)
D. W. Haering & Co., Inc. (17-18)
Hardesty Chemical Co., Inc. (75)
The Pacific Lumber Company (78)
Shell Chemical Corporation (73-74)
Shell Oil Company, Incorporated (73-74)
Stauffer Chemical Co. (62)
U. S. Industrial Chemicals, Inc. (64)

CHEMICALS, Laboratory
California Laboratories (38)
General Chemical Company (32-33)
Nurnberg Thermometer Co., Inc. (95)
Precision Scientific Co. (27)
Redman Scientific Company (8)
Tracerlab, Inc. (38)
U. S. Industrial Chemicals, Inc. (64)

CHEMICALS, Leather
American Cyanamid Company (71-72)
American Resinous Chemicals Corp. (22)
Commercial Solvents Corporation (31)
The Dow Chemical Company (55b-56-57-58)
General Chemical Company (32-33)
The Pacific Lumber Company (78)

CHEMICALS, Paint
American Cyanamid Company (71-72)
Commercial Solvents Corporation (31)
The Dow Chemical Company (55b-56-57-58)
General Chemical Company (32-33)
Glyco Products Co., Inc. (54)
Nurnberg Thermometer Co., Inc. (95)
Shell Chemical Corporation (73-74)
Shell Oil Company, Incorporated (73-74)
U. S. Industrial Chemicals, Inc. (64)

CHEMICALS, Pharmaceutical
American Cyanamid Company (71-72)
Armour and Company, Chemical Research & Development Dept. (100)
Commercial Solvents Corporation (31)
The Dow Chemical Company (55b-56-57-58)
General Chemical Company (32-33)
General Petroleum Corporation (45)
Glyco Products Co., Inc. (54)
Nurnberg Thermometer Co., Inc. (95)
U. S. Industrial Chemicals, Inc. (64)

CHEMICALS, Photographic
American Cyanamid Company (71-72)
Commercial Solvents Corporation (31)
General Chemical Company (32-33)
A. R. Maas Chemical Co. (77)
U. S. Industrial Chemicals, Inc. (64)

CHEMICALS, Plastics
Amecco Chemicals, Inc. (75)
American Cyanamid Company (71-72)
Commercial Solvents Corporation (31)
The Dow Chemical Company (55b-56-57-58)
General Chemical Company (32-33)
Glyco Products Co., Inc. (54)
Hardesty Chemical Co., Inc. (75)
Nurnberg Thermometer Co., Inc. (95)
Shell Chemical Corporation (73-74)
Shell Oil Company, Incorporated (73-74)
U. S. Industrial Chemicals, Inc. (64)

CHEMICALS, Rubber
Amecco Chemicals, Inc. (75)
American Cyanamid Company (71-72)
American Resinous Chemicals Corp. (22)
Commercial Solvents Corporation (31)
The Dow Chemical Company (55b-56-57-58)
General Chemical Company (32-33)
Glyco Products Co., Inc. (54)
Hardesty Chemical Co., Inc. (75)
U. S. Industrial Chemicals, Inc. (64)

CHEMICALS, Textile
Amecco Chemicals, Inc. (75)
American Cyanamid Company (71-72)
American Resinous Chemicals Corp. (22)
Commercial Solvents Corporation (31)
The Dow Chemical Company (55b-56-57-58)
General Chemical Company (32-33)
Glyco Products Co., Inc. (54)
Hardesty Chemical Co., Inc. (75)
U. S. Industrial Chemicals, Inc. (64)

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American Cyanamid Company (71-72)
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Chemical Equipment Co. (66)
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D. W. Haering & Co., Inc. (17-18)

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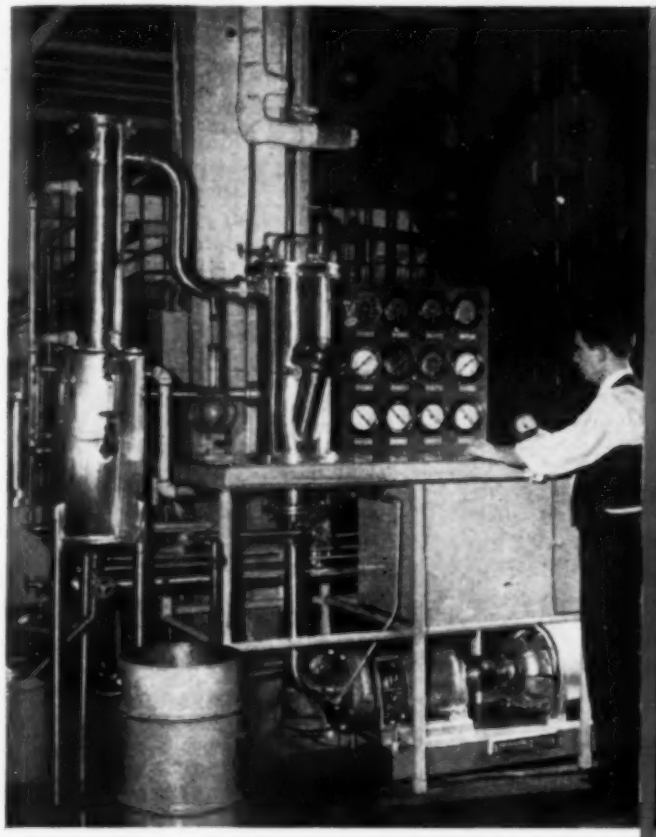

Forced Circulation Evaporator for concentrating viscous materials too heavy to be concentrated by natural circulation. Complete instrumentation shows all operating functions.

Processing Kettle for heating, cooling, concentrating and mixing, atmospherically or under vacuum.

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WHAT? Equipment will give the best results?

WHY? Is this method superior to others?

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These new BUFLOVAK Pilot Plant units, along with other equipment, that lead the way to better chemical and food processes, will be demonstrated at the Pacific Chemical Show.

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And, this work is done in a most practical way. A small quantity of material is processed on small equipment that gives accurate indexes to full scale operation. Results are positive! The product's response to different processes are shown. The finished product can be examined for all of its characteristics. Capacities, costs and methods are known.

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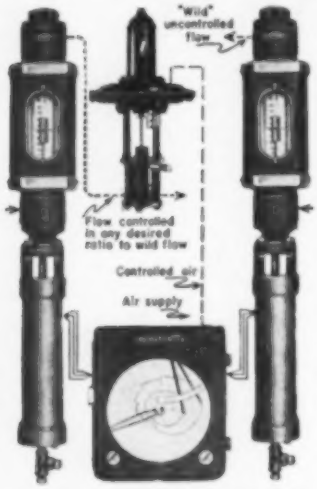
In problems involving drying, evaporation, extraction, impregnation, solvent recovery, crystallization, etc. this cooperative service can help you, as it has 5000 others in the past 35 years. And, it will safeguard your investment in BUFLOVAK equipment because you will be assured of getting the most efficient equipment, the right size, and the correct accessories to insure satisfactory, profitable operation.

Buflovak Equipment DIVISION OF BLAW-KNOX COMPANY

1551 FILLMORE AVE., BUFFALO 11, N.Y.

AUTOMATIC FLOW RATIO CONTROL



The proportioning of fluids, passing through two or more different pipe lines, becomes really practical with the FLOWRATOR variable area type flow meter. For satisfactory ratio control, the linear calibration scale of FLOWRATOR instruments is a necessity.

Send for catalog 50 which describes how difficult proportional control problems can become easy and also reasonable in price.

LABORATORY FLOW RATE METER

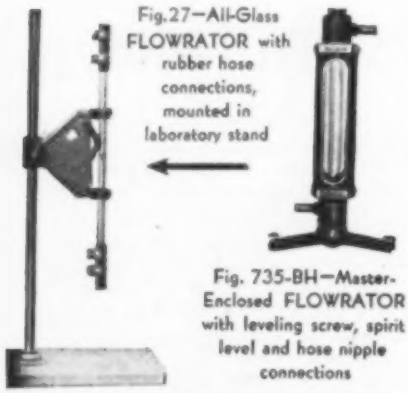


Fig. 27—All-Glass FLOWRATOR with rubber hose connections, mounted in laboratory stand

Fig. 735-BH—Master-Enclosed FLOWRATOR with leveling screw, spirit level and hose nipple connections

The F & P FLOWRATOR, variable area type flow meter, permits an instantaneous reading of the true flow rate. Each instrument is accurately calibrated at our factory for your exact requirements.

Liquid flows down to 0.15 cc per min. and gas flows down to 3.0 cc per min. can be measured with ease. All-glass meters are now sold at EVEN LOWER prices than prevailed during the war.

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FISCHER & PORTER CO.
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A. R. Maas Chemical Co. (77)
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Shell Chemical Corporation (73-74)
Shell Oil Company, Incorporated (73-74)

CHLORINE
Chemco (66)
Chemical Equipment Co. (66)
The Dow Chemical Company (55b-56-57-58)
Stauffer Chemical Co. (62)

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Commercial Filters Corporation (67)
Ertel Engineering Corporation (60)
Fischer & Porter Company (96)
Montgomery Brothers (67)
Niagara Filter Corp. (99)
Philadelphia Quartz Co. of Calif. (101)

CLASSIFIERS
Patterson Foundry & Machine Co. (89)

COATINGS
American Resinous Chemicals Corp. (22)
The Dow Chemical Company (55b-56-57-58)
D. W. Haering & Co., Inc. (17-18)
Nurnberg Thermometer Co., Inc. (95)
Philadelphia Quartz Co. of Calif. (101)

COLLOID MILLS, Industrial
Fernholtz Machinery Company (10)

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American Cyanamid Company (71-72)
American Resinous Chemicals Corp. (22)
Reichhold Chemicals, Inc. (23-24-25)

CONDENSERS AND COOLERS, Industrial
American Heat Reclaiming Corporation (2-3)
G. M. Cooke Factory Representative (6)
The Fluor Corporation, Ltd. (37)
Patterson Foundry & Machine Co. (89)
Pfaudler Sales Co. (7)
Schutte & Koerting Co. (6)

CONTAINERS AND PACKAGES
Bagpak Division, International Paper Co. (30)
Bemis Bro. Bag Co. (50)
The Container Company, Div. of Continental Can Co., Inc. (76)
Continental Can Co., Inc., The Container Company Div. (76)
International Paper Co., Bagpak Division (30)

CONTROLLERS AND CONTROL SYSTEMS
G. M. Cooke Factory Representative (6)
Fischer & Porter Company (96)
Nurnberg Thermometer Co., Inc. (95)
Schutte & Koerting Co. (6)

COOKERS—See Digestors

COOLERS—See Condensers

CRUCIBLES, Industrial

CRUSHERS, GRINDS, MILLS AND PULVERIZERS, Industrial
L. H. Butcher Co. (41)
Fernholtz Machinery Company (10)
The W. J. Fitzpatrick Company (81)
Patterson Foundry & Machine Co. (89)
Stedman's Foundry & Machine Works (2-3)

DECOLORIZING AND PURIFYING MATERIALS
Chemco (66)
Chemical Equipment Co. (66)
Chemical Process Company (48)
Ertel Engineering Corporation (60)
National Perlite Company (5)

DESICCANTS
The Dow Chemical Company (55b-56-57-58)
General Petroleum Corporation (45)
W. A. Hammond Drierite Company (97)

DETERGENTS
Amecco Chemicals, Inc. (75)
American Cyanamid Company (71-72)
Armour and Company, Chemical Research & Development Dept. (100)
General Chemical Company (32-33)
Hardesty Chemical Co., Inc. (75)
A. R. Maas Chemical Co. (77)
Stauffer Chemical Co. (62)

DIGESTORS AND COOKERS
L. H. Butcher Co. (41)
Nurnberg Thermometer Co., Inc. (95)
Patterson Foundry & Machine Co. (89)
Pfaudler Sales Co. (7)

DISINFECTANTS AND DISINFECTANT BASES
American Cyanamid Company (71-72)
Commercial Solvents Corporation (31)
The Dow Chemical Company (55b-56-57-58)

DISTILLING EQUIPMENT, Industrial
Aetna Scientific Company (16)
L. H. Butcher Co. (41)
Chemco (66)
Chemical Equipment Co. (66)
Fischer & Porter Company (96)
Patterson Foundry & Machine Co. (89)
Pfaudler Sales Co. (7)
Precision Scientific Co. (27)
Process Equipment Corporation (61)

DRYING EQUIPMENT
L. H. Butcher Co. (41)
Electric Steel Foundry Company (93-94)
Fernholtz Machinery Company (10)
W. A. Hammond Drierite Company (97)
Nurnberg Thermometer Co., Inc. (95)
Patterson Foundry & Machine Co. (89)
Pfaudler Sales Co. (7)
Pittsburgh LECTRODRYER Corporation (2-3)
Schutte & Koerting Co. (6)

DUST COLLECTING SYSTEMS
Claude B. Schneible Company (80)
Schutte & Koerting Co. (6)

(*Continued on page* 322)

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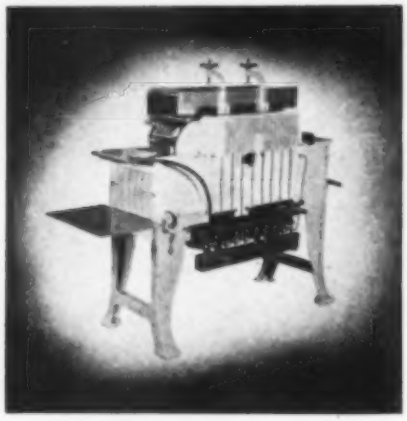

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DYES AND INTERMEDIATES
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The Dow Chemical Company (55b–56–57–58)
U. S. Industrial Chemicals, Inc. (64)

EJECTORS
Chemco (66)
Chemical Equipment Co. (66)
The Duriron Company, Inc. (2–3)
Fischer & Porter Company (96)
Schutte & Koerting Co. (6)

ELECTRICAL EQUIPMENT AND SUPPLIES, Industrial
Nurnberg Thermometer Co., Inc. (95)

ELECTROPLATING EQUIPMENT AND SUPPLIES
Philadelphia Quartz Co. of Calif. (101)

EMULSIFIERS
American Cyanamid Company (71–72)
American Resinous Chemicals Corp. (22)
Commercial Solvents Corporation (31)
The W. J. Fitzpatrick Company (81)
Glyco Products Co., Inc. (54)
Philadelphia Quartz Co. of Calif. (101)

ENGINEERS
L. H. Butcher Co. (41)
Electric Steel Foundry Company (93–94)
Ertel Engineering Corporation (60)
Niagara Filter Corp. (99)

ENZYMES
Armour and Company, Chemical Research & Development Dept. (100)

ESTERS
American Cyanamid Company (71–72)
Commercial Solvents Corporation (31)
The Dow Chemical Company (55b–56–57–58)
Glyco Products Co., Inc. (54)
U. S. Industrial Chemicals, Inc. (64)

ETHERS
Commercial Solvents Corporation (31)
The Dow Chemical Company (55b–56–57–58)
Shell Chemical Corporation (73–74)
Shell Oil Company, Incorporated (73–74)
U. S. Industrial Chemicals, Inc. (64)

EVAPORATORS
Electric Steel Foundry Company (93–94)
Patterson Foundry & Machine Co. (89)
Pfaudler Sales Co. (7)
Precision Scientific Co. (27)

EXHAUSTERS—See Fans

EXPLOSIVES
American Cyanamid Company (71–72)

EXTRACTION EQUIPMENT
Niagara Filter Corp. (99)
Nurnberg Thermometer Co., Inc. (95)
Pfaudler Sales Co. (7)

FANS, BLOWERS AND EXHAUSTERS
The Duriron Company, Inc. (2–3)
Fernholtz Machinery Company (10)
Nurnberg Thermometer Co., Inc. (95)
Schutte & Koerting Co. (6)

FERTILIZERS
American Cyanamid Company (71–72)
Shell Chemical Corporation (73–74)
Shell Oil Company, Incorporated (73–74)

FILLING EQUIPMENT—See Packaging Equipment

FILTER MEDIA
Chemco (66)
Chemical Equipment Co. (66)
Ertel Engineering Corporation (60)
Hercules Filter Corporation (14)
National Perlite Company (5)
The Pacific Lumber Company (78)
Sparkler Manufacturing Company (108)

FILTERS AND FILTER PRESSES
L. H. Butcher Co. (41)
Chemco (66)
Chemical Equipment Co. (66)
Commercial Filters Corporation (67)
Ertel Engineering Corporation (60)
Fernholtz Machinery Company (10)
Hercules Filter Corporation (14)
The Jack-Stiehl Company (2–3)
Montgomery Brothers (67)
Niagara Filter Corp. (99)
Patterson Foundry & Machine Co. (89)
Sparkler Manufacturing Company (108)

FIRE AND FLAMEPROOFING MATERIALS
Glyco Products Co., Inc. (54)

FITTINGS, Valve and Pipe
American Hard Rubber Co. (66)
Armstrong Machine Works (107)
Autoclave Engineers, Inc. (27)
Bonney Forge & Tool Works (28)
A. B. Boyd Co. (66)
Bushnell Controls and Equipment Co. (98)
L. H. Butcher Co. (41)
Chemco (66)
Chemical Equipment Co. (66)
G. M. Cooke Factory Representative (6)
Cooper Alloy Foundry Co. (28)
Walter L. Duhig (28–29)
The Duriron Company, Inc. (2–3)
Electric Steel Foundry Company (93–94)
Fischer & Porter Company (96)
Hills-McCanna Company (2–3)
The Jack-Stiehl Company (2–3)
The Johnson Corporation (65)
Ladish Co. (79)
The Pacific Lumber Company (78)
Perfecting Service Company (98)
Pfaudler Sales Co. (7)
Schutte & Koerting Co. (6)
The Watson-Stillman Co. (29)

FLOTATION AGENTS
American Cyanamid Company (71–72)
Armour and Company, Chemical Research & Development Dept. (100)
The Dow Chemical Company (55b–56–57–58)
Philadelphia Quartz Co. of Calif. (101)
Shell Chemical Corporation (73–74)
Shell Oil Company, Incorporated (73–74)
U. S. Industrial Chemicals, Inc. (64)

FLUORIDES
General Chemical Company (32–33)
American Cyanamid Company (71–72)

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Beckman pH Control is the modern miracle tool with which industries of all types are boosting production efficiencies, reducing waste, obtaining better products at lower operating costs. No matter what your product or operation... whether metal finishing, power plant operation, agriculture, food processing, sewage and waste disposal, water supply, chemical processing, oil refining, textile manufacture—to mention only a few ... if you use water or water solutions anywhere—in vats, tanks or flow lines—investigate the savings that can be made, perhaps are already being made by your competitors, with the aid of modern Beckman pH Control.

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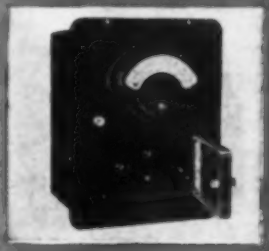

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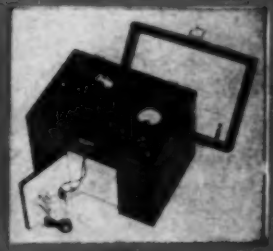

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FORMATES
Commercial Solvents Corporation (31)

FUNGICIDES
Amecco Chemicals, Inc. (75)
American Cyanamid Company (71-72)
The Dow Chemical Company (55b-56-57-58)
General Chemical Company (32-33)
General Petroleum Corporation (45)
Hardesty Chemical Co., Inc. (75)
Stauffer Chemical Co. (62)

FURNACES, Industrial
Nurnberg Thermometer Co., Inc. (95)

GAS HANDLING EQUIPMENT
The Fluor Corporation, Ltd. (37)

GASES
U. S. Industrial Chemicals, Inc. (64)

GAUGES
G. M. Cooke Factory Representative (6)
Fischer & Porter Company (96)
Meriam Instrument Co. (6)
Nurnberg Thermometer Co., Inc. (95)

GERMICIDES
Armour and Company, Chemical Research & Development Dept. (100)
L. H. Butcher Co. (41)
The Dow Chemical Company (55b-56-57-58)

GLASS, Fiber

GLASS, Optical
Macbeth Corporation (106)
Nurnberg Thermometer Co., Inc. (95)

GLASS PIPE
Fischer & Porter Company (96)
Nurnberg Thermometer Co., Inc. (95)
Pfaudler Sales Co. (7)

GLASSWARE, Laboratory
Ace Glass Incorporated (52)
Fischer & Porter Company (96)
Nurnberg Thermometer Co., Inc. (95)
Redman Scientific Company (8)

GLUCOSATES
D. W. Haering & Co., Inc. (17-18)

GLYCERINE AND DERIVATIVES
Glyco Products Co., Inc. (54)

GLYCOLS—See Alcohols, Polyhydric

GRINDERS—See Crushers

HALIDES
Amecco Chemicals, Inc. (75)
The Dow Chemical Company (55b-56-57-58)
General Chemical Company (32-33)
Hardesty Chemical Co., Inc. (75)

HALO-AROMATICS
Amecco Chemicals, Inc. (75)
The Dow Chemical Company (55b-56-57-58)
Glyco Products Co., Inc. (54)
Hardesty Chemical Co., Inc. (75)

HALOGENS
The Dow Chemical Company (55b-56-57-58)

HEAT TRANSFER AGENTS
The Dow Chemical Company (55b-56-57-58)

HEATERS AND HEAT EXCHANGERS
American Heat Reclaiming Corporation (2-3)
L. H. Butcher Co. (41)
G. M. Cooke Factory Representative (6)
Electric Steel Foundry Company (93-94)
Fernholtz Machinery Company (10)
The Fluor Corporation, Ltd. (37)
The Jack-Stiehl Company (2-3)
Patterson Foundry & Machine Co. (89)
Pfaudler Sales Co. (7)
Schutte & Koerting Co. (6)

HIGH VACUUM EQUIPMENT
Redman Scientific Company (8)

HOISTS
L. H. Butcher Co. (41)

HOMOGENIZERS, Industrial
The W. J. Fitzpatrick Company (81)
Pfaudler Sales Co. (7)

HUMIDIFYING APPARATUS
Armstrong Machine Works (107)

HYDROCARBON GASES

HYDROCARBONS
The Dow Chemical Company (55b-56-57-58)
General Petroleum Corporation (45)

HYDROGEN ION APPARATUS—See pH Equipment

HYDROXYLAMINES
Commercial Solvents Corporation (31)

INDUSTRIAL RESEARCH
California Laboratories (38)
Tracerlab, Inc. (38)

INHIBITORS
Commercial Solvents Corporation (31)
The Dow Chemical Company (55b-56-57-58)
D. W. Haering & Co., Inc. (17-18)
The Pacific Lumber Company (78)
Philadelphia Quartz Co. of Calif. (101)

INSECTICIDES AND BASES
Amecco Chemicals, Inc. (75)
American Cyanamid Company (71-72)
L. H. Butcher Co. (41)
Commercial Solvents Corporation (31)
The Dow Chemical Company (55b-56-57-58)
General Chemical Company (32-33)
General Petroleum Corporation (45)
Glyco Products Co., Inc. (54)
Hardesty Chemical Co., Inc. (75)
Stauffer Chemical Co. (62)

INSTRUMENT REPAIRING
Redman Scientific Company (8)

INSTRUMENTS, Electrical-Industrial
Fischer & Porter Company (96)
Macbeth Corporation (106)
Nurnberg Thermometer Co., Inc. (95)

INSTRUMENTS, Electrical-Laboratory
Fischer & Porter Company (96)
Macbeth Corporation (106)
National Technical Laboratories (55a)
Nurnberg Thermometer Co., Inc. (95)
Precision Scientific Co. (27)
Redman Scientific Company (8)

(Continued on page 326)

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Don't let corrosion eat up your equipment, shut down your operations, or contaminate your processes! A little extra investment in ACE hard rubber tanks, pumps, valves and piping for your storage, processing, or circulating systems will save many times its cost.

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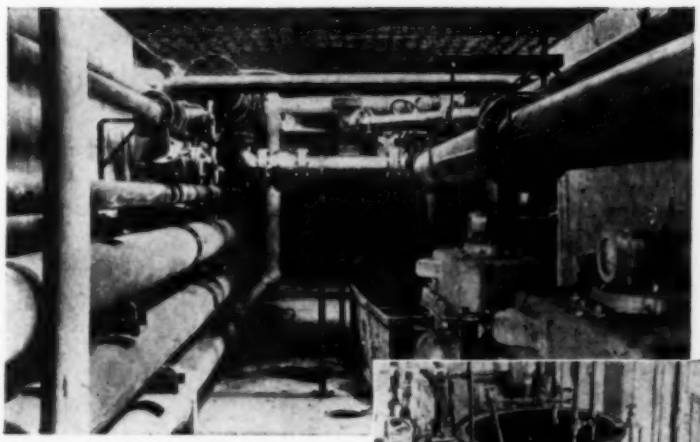
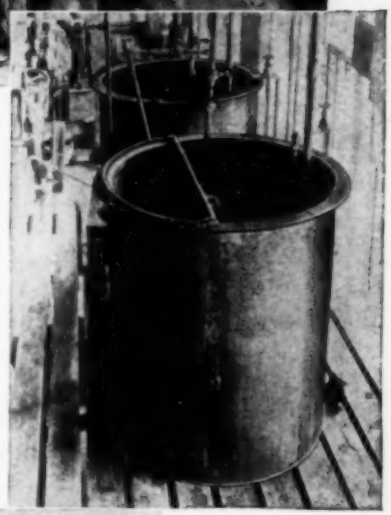


ACE rubber lined pipe, fittings, valves and tank, and ACE all-hard-rubber pipe and fittings are used in this one installation



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Abrasive, acidulous water is handled by this ACE pipe lined with ¼" soft rubber, in service more than 8 years

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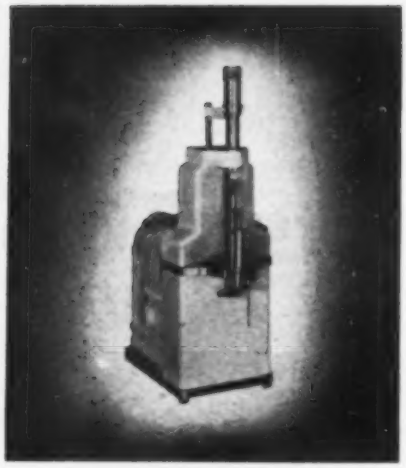

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Fischer & Porter Company (96)
Macbeth Corporation (106)
Meriam Instrument Co. (6)
National Technical Laboratories (55a)
Nurnberg Thermometer Co., Inc. (95)
Precision Scientific Co. (27)
Redman Scientific Company (8)
Schutte & Koerting Co. (6)
Tracerlab, Inc. (38)

INSTRUMENTS, Testing-Industrial
Bushnell Controls and Equipment Co. (98)
G. M. Cooke Factory Representative (6)
Fischer & Porter Company (96)
Macbeth Corporation (106)
Meriam Instrument Co. (6)
Nurnberg Thermometer Co., Inc. (95)
Perfecting Service Company (98)
Precision Scientific Co. (27)
Redman Scientific Company (8)
Schutte & Koerting Co. (6)

INSULATING MATERIALS AND SUPPLIES
National Perlite Company (5)
The Pacific Lumber Company (78)

ION EXCHANGE EQUIPMENT
American Cyanamid Company (71-72)
Chemco (66)
Chemical Equipment Co. (66)
Process Equipment Corporation (61)

ION EXCHANGE RESINS
American Cyanamid Company (71-72)
Chemco (66)
Chemical Equipment Co. (66)
Chemical Process Company (48)
The Dow Chemical Company (55b-56-57-58)
Process Equipment Corporation (61)

JOINTS, Flexible
Barco Manufacturing Co., Not Inc. (105)
Bushnell Controls and Equipment Co. (98)
The Johnson Corporation (65)
Perfecting Service Company (98)

KETONES
American Cyanamid Company (71-72)
Armour and Company, Chemical Research & Development Dept. (100)
Commercial Solvents Corporation (31)
Shell Chemical Corporation (73-74)
Shell Oil Company, Incorporated (73-74)
U. S. Industrial Chemicals, Inc. (64)

KETTLES
Patterson Foundry & Machine Co. (89)
Pfaudler Sales Co. (7)

KILNS
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LABORATORIES, Testing

LABORATORY APPARATUS AND SUPPLIES
Aetna Scientific Company (16)
American Hard Rubber Co. (66)
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Cooper Alloy Foundry Co. (28)
Walter L. Duhig (28-29)
Ertel Engineering Corporation (60)
Fischer & Porter Company (96)
Macbeth Corporation (106)
National Technical Laboratories (55a)
Niagara Filter Corp. (99)
Nurnberg Thermometer Co., Inc. (95)
Pfaudler Sales Co. (7)
Precision Scientific Co. (27)
Redman Scientific Company (8)
Tracerlab, Inc. (38)

LABORATORY FURNITURE
Alberene Stone Corporation of Virginia (2-3)
Nurnberg Thermometer Co., Inc. (95)
Redman Scientific Company (8)

LACQUERS AND BASES
American Cyanamid Company (71-72)
American Resinous Chemicals Corp. (22)
U. S. Industrial Chemicals, Inc. (64)

LININGS, Corrosion Resistant
American Hard Rubber Co. (66)
American Resinous Chemicals Corp. (22)
A. B. Boyd Co. (66)
Chemco (66)
Chemical Equipment Co. (66)
Patterson Foundry & Machine Co. (89)
Pfaudler Sales Co. (7)

LUBRICANT ADDITIVES
Amecco Chemicals, Inc. (75)
American Cyanamid Company (71-72)
Commercial Solvents Corporation (31)
Glyco Products Co., Inc. (54)
Hardesty Chemical Co., Inc. (75)

LUBRICANTS

MAGNESIUM AND ALLOYS
The Dow Chemical Company (55b-56-57-58)

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Cesco Inc. (4)
Columbia Engineering Service Company (4)
Eriez Manufacturing Company (59)

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MANOMETERS, Industrial
Chemco (66)
Chemical Equipment Co. (66)
G. M. Cooke Factory Representative (6)
Meriam Instrument Co. (6)
Nurnberg Thermometer Co., Inc. (95)

MATERIALS HANDLING EQUIPMENT
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Eriez Manufacturing Company (59)
Ertel Engineering Corporation (60)
Fernholtz Machinery Company (10)
National Engineering Company (82)
Milton Roy Company (85)

(Continued on page 328)

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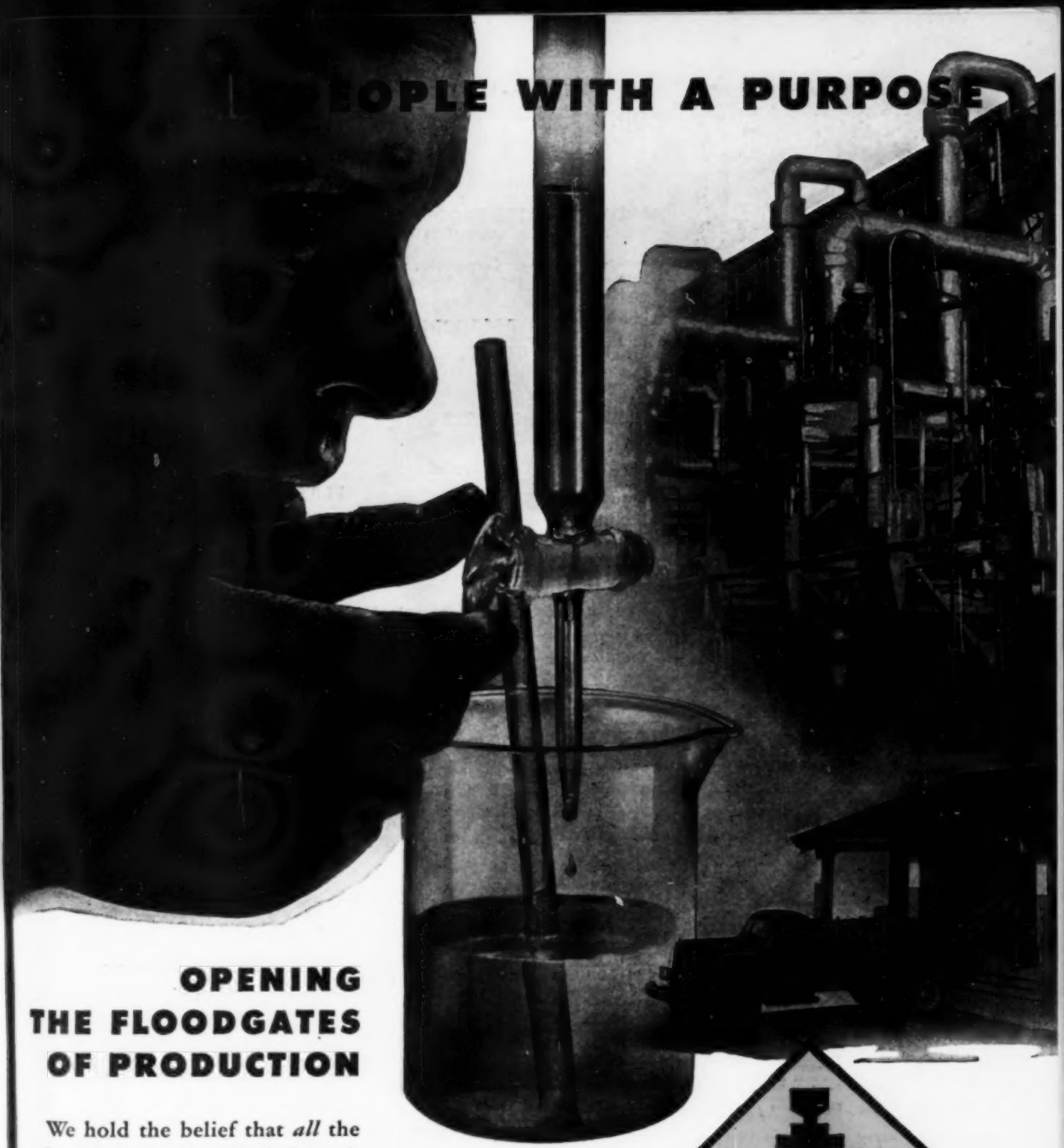

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PUBLICATIONS
American Chemical Society (109)
Chemical Engineering (46)
Chemical and Engineering News (109)
Chemical Industries (63)
Food Industries (46)
Industrial and Engineering Chemistry (109)
McGraw-Hill Publishing Co., Inc., (46)

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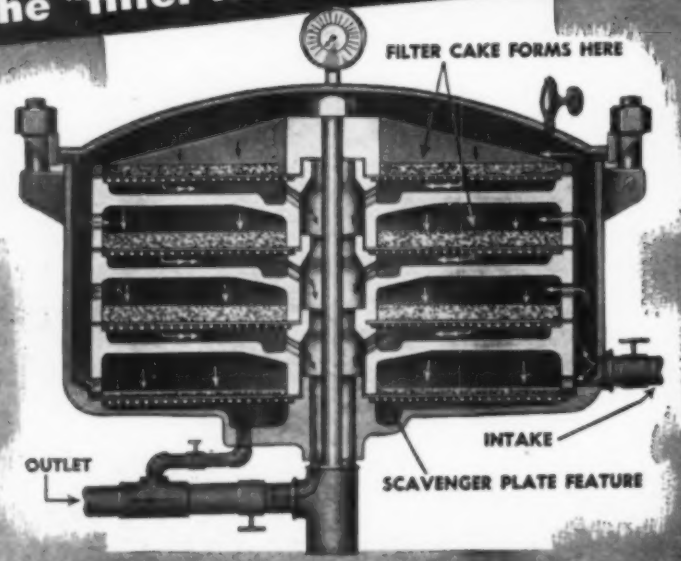

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U. S. Industrial Chemicals, Inc. (04)

(*Continued on page 333*)

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Chemical Equipment Co. (66)
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Nurnberg Thermometer Co., Inc. (95)

REGULATORS, Temperature
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Nurnberg Thermometer Co., Inc. (95)
Redman Scientific Company (8)

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Glyco Products Co., Inc. (54)
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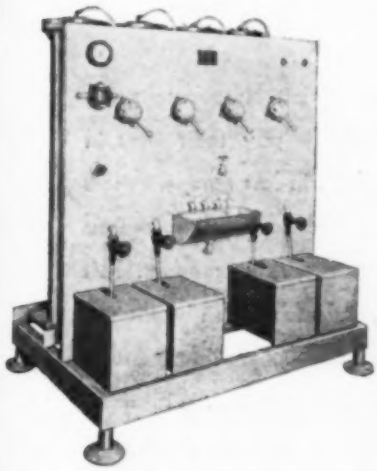

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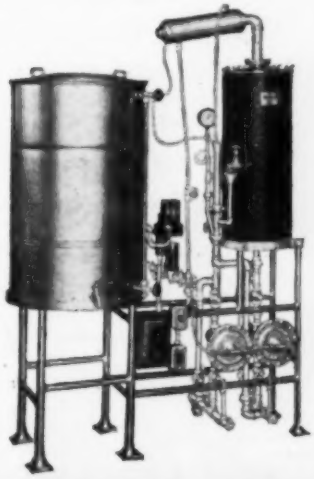

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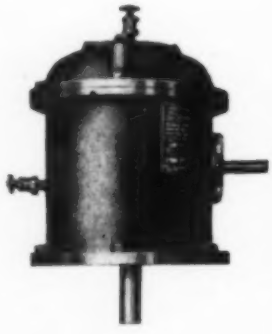

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Commercial Solvents Corporation (31)

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American Cyanamid Company (71-72)
American Resinous Chemical Corp. (22)
Commercial Solvents Corporation (31)
The Dow Chemical Company (55b-56-57-58)
General Chemical Company (32-33)
Hardesty Chemical Co., Inc. (75)

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General Petroleum Corporation (45)
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General Chemical Company (32-33)
General Petroleum Corporation (45)
Shell Chemical Corporation (73-74)
Shell Oil Company, Incorporated (73-74)
Stauffer Chemical Co. (62)
U. S. Industrial Chemicals, Inc. (64)

SOLVENTS, Aromatic
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The Dow Chemical Company (55b-56-57-58)

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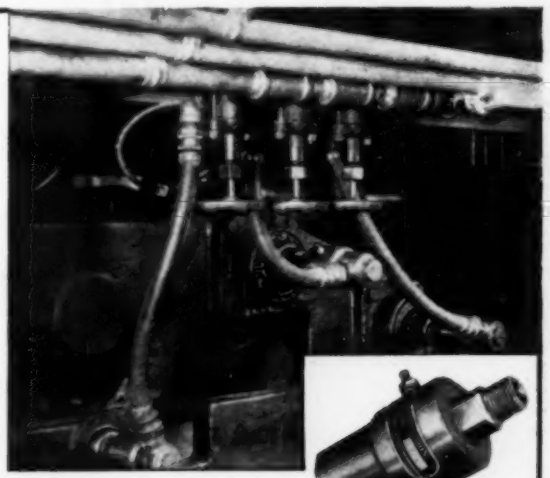

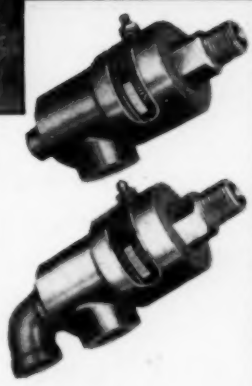

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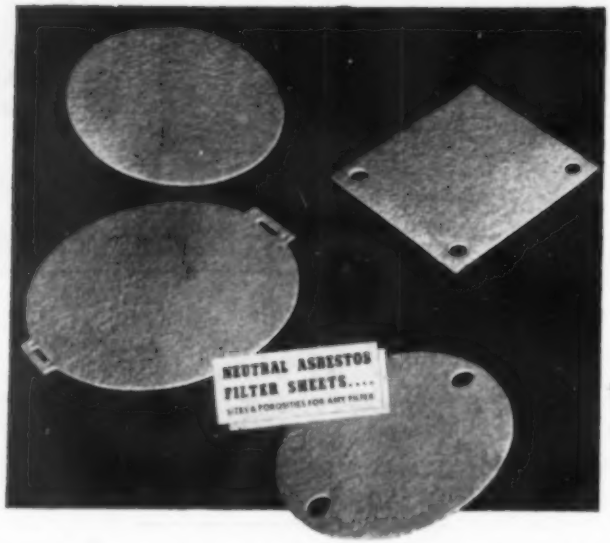

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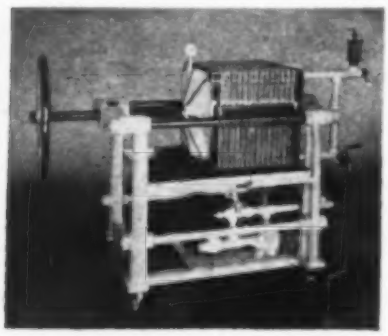

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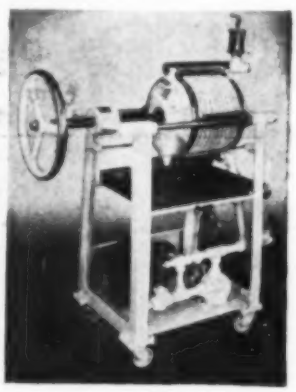

WRITE FOR ILLUSTRATED CATALOG 15

ERTEL
FLUID HANDLING EQUIPMENT

ERTEL ENGINEERING
CORPORATION
KINGSTON NEW YORK

New York City Sales Office: 40 West 48th Street, New York 19, N. Y.

ASBESTOS FILTER SHEETS • ASBESTOS SHEET FILTERS
BOTTLE FILLERS • PORTABLE MIXERS • PLASTIC PUMPS

EXHIBITORS
Classified by Products
CONTINUED

SCIENTIFIC INSTRUMENTS AND SUPPLIES
(Continued)

Precision Scientific Co. (27)
Redman Scientific Company (8)
Schutte & Koerting Co. (6)
Tracerlab, Inc. (38)

SCREENS, VIBRATORS, ETC., Industrial
L. H. Butcher Co. (41)
Fernholtz Machinery Company (10)
Patterson Foundry & Machine Co. (89)
Orville Simpson Company (23)

SEBACATES
Amecco Chemicals, Inc. (75)
Commercial Solvents Corporation (31)
Hardesty Chemical Co., Inc. (75)

SEPARATORS
Cesco Inc. (4)
Columbia Engineering Service Company (4)
Eriez Manufacturing Company (59)
Nurnberg Thermometer Co., Inc. (95)

SILICATES, Inorganic
Philadelphia Quartz Co. of Calif. (101)

SILICATES, Organic

SOCIETIES, Technical

TANKS
American Hard Rubber Co. (66)
Bonney Forge & Tool Works (28)
A. B. Boyd Co. (66)
L. H. Butcher Co. (41)
Chemco (66)
Chemical Equipment Co. (66)
Walter L. Duhig (28-29)
The Pacific Lumber Company (78)
Pfaudler Sales Co. (7)
Precision Scientific Co. (27)

TANNING—See Chemicals, Leather

THERMOMETERS, Industrial
Nurnberg Thermometer Co., Inc. (95)

TOWERS AND PACKING
The Pacific Lumber Company (78)
Pfaudler Sales Co. (7)

TRAPS, Steam
Armstrong Machine Works (107)

TUNGSTEN AND ALLOYS

UREA AND DERIVATIVES
American Cyanamid Company (71-72)
Reichhold Chemicals, Inc. (23-24-25)

VALVES—See Fittings

VARNISH AND BASES
American Cyanamid Company (71-72)
U. S. Industrial Chemicals, Inc. (64)

(Continued on page 337)

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EXHIBITORS
Classified by Products
CONTINUED

VENTILATING EQUIPMENT
G. M. Cooke Factory Representative (6)
Fernholtz Machinery Company (10)
Claude B. Schneible Company (80)
Schutte & Koerting Co. (6)

VITAMINS
American Cyanamid Company (71-72)
Commercial Solvents Corporation (31)
U. S. Industrial Chemicals, Inc. (64)

WATER TREATMENT CHEMICALS AND EQUIPMENT
American Cyanamid Company (71-72)
L. H. Butcher Co. (41)
Chemco (66)
Chemical Equipment Co. (66)
The Dow Chemical Company (55b-56-57-58)
Ertel Engineering Corporation (60)
Fernholtz Machinery Company (10)
Fischer & Porter Company (96)
General Chemical Company (32-33)
D. W. Haering & Co., Inc. (17-18)
The Pacific Lumber Company (78)
Philadelphia Quartz Co. of Calif. (101)
Process Equipment Corporation (61)
Stauffer Chemical Co. (62)

WAXES
American Cyanamid Company (71-72)
American Resinous Chemicals Corp. (22)
Armour and Company, Chemical Research & Development Dept. (100)
Bareco Oil Company (49)
General Petroleum Corporation (45)
Glyco Products Co., Inc. (54)

WETTING AGENTS
American Cyanamid Company (71-72)
Armour and Company, Chemical Research & Development Dept. (100)
Commercial Solvents Corporation (31)
Glyco Products Co., Inc. (54)
U. S. Industrial Chemicals, Inc. (64)

XANTHATES
American Cyanamid Company (71-72)
The Dow Chemical Company (55b-56-57-58)

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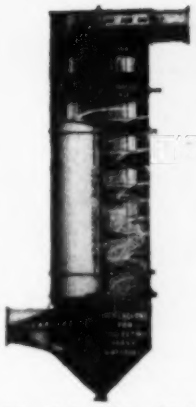

The Schneible Multi-Wash Collector — the heart of the Schneible System — receives the dust and fume-laden air picked up at the sources, and thoroughly removes contamination from the air before it is discharged. The collected material is converted into a sludge, which is much more readily disposed of than an accumulation of dust, and cannot re-contaminate the atmosphere.

5 ADVANTAGES OF SCHNEIBLE DUST AND FUME CONTROL —IMPORTANT TO YOUR POCKETBOOK!

The present equipment employed in a Schneible system has emerged from the experience of over 25 years of controlling dust and fume creating operations in the process industries. As a result, Schneible equipment —

1. Provides the demonstrated advantages and greater safety of the wet method of dust control.
2. Requires a minimum of exhaust air from the operations being ventilated.
3. Occupies a minimum of space.
4. Is made of the material which best withstands destructive effects of contamination handled.
5. Effectively copes with the various dust and fume conditions encountered in the process industries.

See us at Pacific Chemical Exposition; Booth 80 . . . also at Chemical Industries Exposition, New York; Booths 421-422.

Submit your dust and fume problems.

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Visit
Chemical Engineering
in
Booth 46

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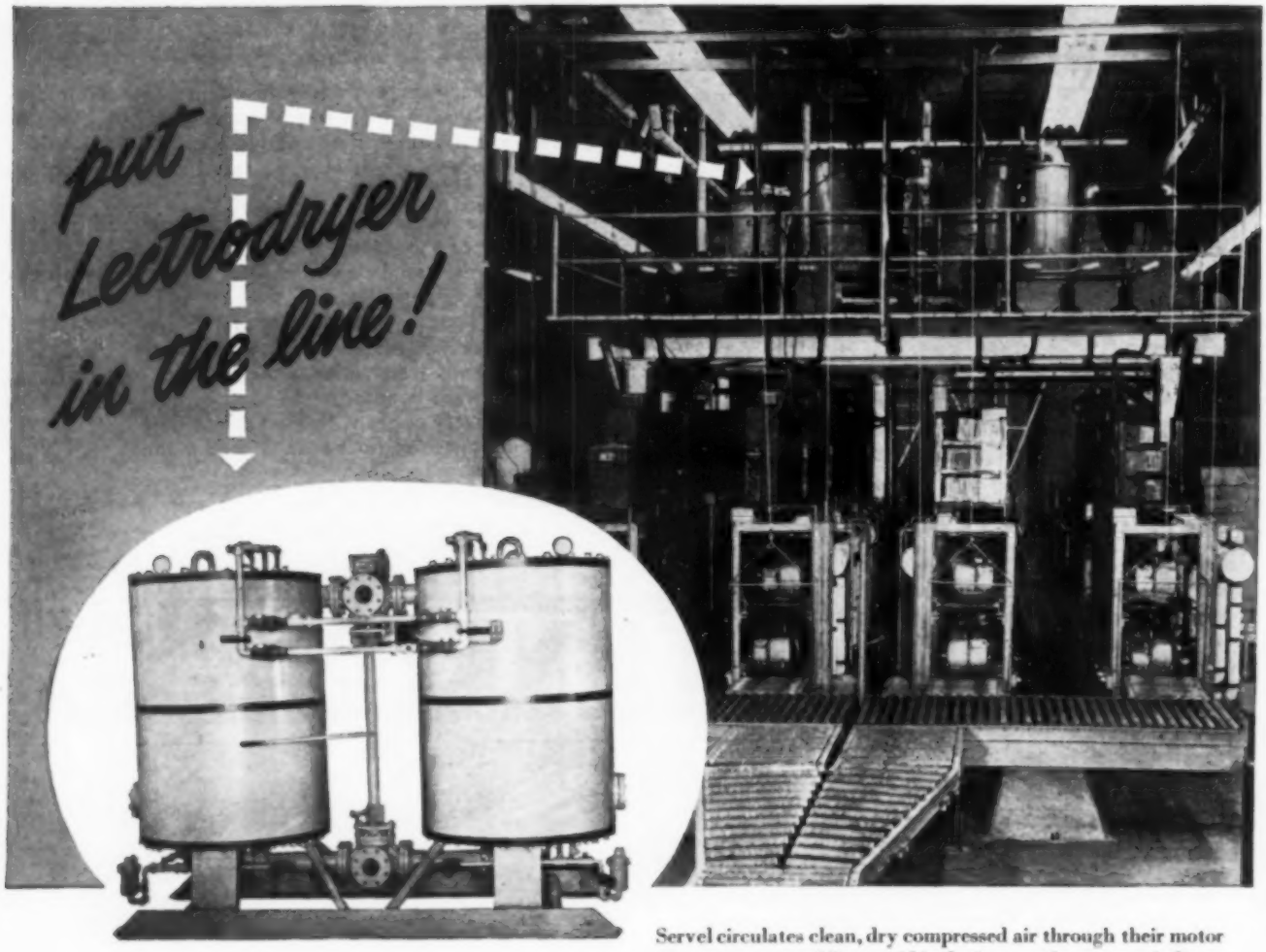
WHEN YOU'RE TOOLING UP FOR PRODUCTION



Servel circulates clean, dry compressed air through their motor compressor assemblies to aid in drying out the motor windings. Lectrodryer does the DRYing; a Lectrofilter removes all oil.

Use these DRYing machines just like any other machine tool. Spot them right in the assembly line where their drying function is required. Put them "on stream" in your chemical processes.

Lectrodryers work 24 hours a day—no rest periods or down time—one column taking over the DRYing job while the other is being regenerated by heat. This cycle can be controlled automatically or manually. At Servel, the foremen reverse the valve at the start of every eight-hour shift.

Air, gases or organic liquids—Lectrodryers DRY them all. In laboratory volumes or wholesale, at atmospheric pressure up to 3,000 pounds per square inch, to moderate dewpoints or as low as −100° F.—there are Lectrodryers to handle them all.

Lectrodryer engineers welcome your inquiries. No need to waste your valuable time on unfamiliar DRYing problems. Write Pittsburgh Lectrodryer Corporation, 303 32nd Street, Pittsburgh, Penna.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In Australia: Birlec, Limited, 51 Parramatta Road, Glebe, Sidney.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

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